Engineering and Mining Journal

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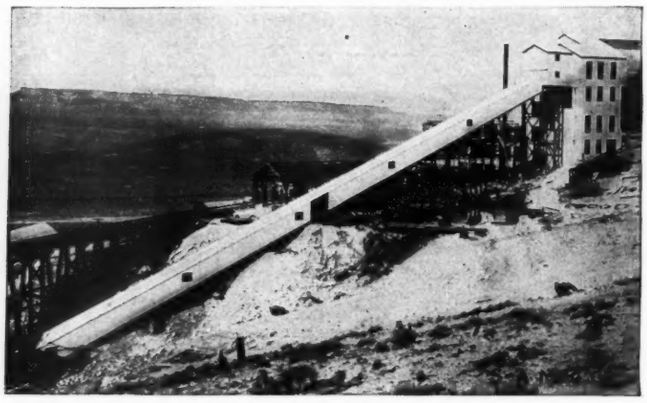

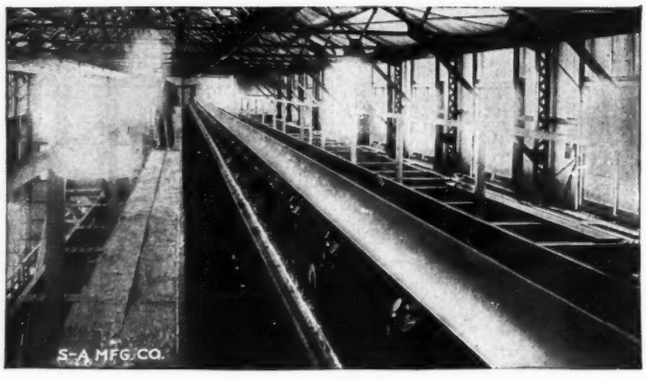

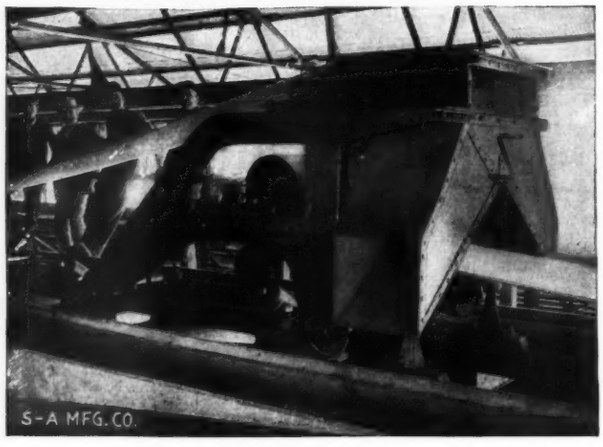

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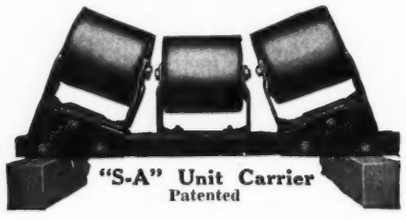

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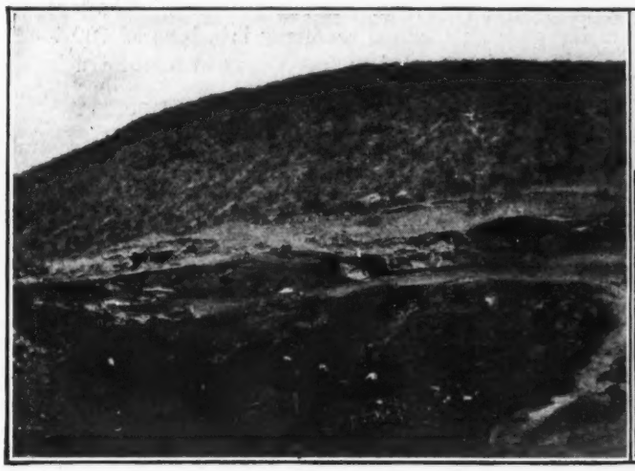
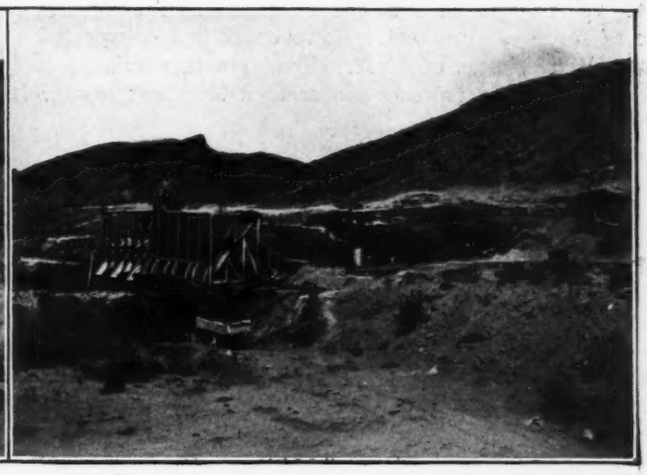


MAIN OPENCUT, THREE KIDS CLAIM, SHOWING 25-FT. BREAST OF MANGANESE ORE



CENTRAL VIEW, THREE KIDS CLAIM, MANGANESE ASSOCIATION, CLARK COUNTY, NEVADA

Manganese Deposits of Clark County, Nevada

BY FRED A. HALE, JR.*

The Las Vegas manganese field, in Clark County, Nevada, contains promising deposits of 40% manganese ore that is low in phosphorus and iron. In spite of the inaccessibility of the claims, one property is already shipping 150 tons daily at a fair profit, which will be increased with the advent of the railroad. Ore being shipped is taken from pits by quarrying methods.

SINCE the beginning of the war, with the consequent increased demand for manganese ores, prospectors of the Southwest have instituted a keen search for these ores, with the result that many promising outcrops have been discovered. The most important of these lie in a belt roughly delineated by the course of the Colorado River, forming the boundary between Arizona on the south, and Nevada and California on the north. Deposits have been found on both sides of the Colorado, extending as far north as the Virgin River and southward into San Bernardino and Riverside counties, in California, a distance of about 150 miles.

Owing to the inaccessibility of many of the deposits, and the extreme rugged nature of the country, development has been somewhat slow, and production from the newly discovered zone has so far been small. With the exception of small shipments from various points in Arizona and California, the only production of importance has been derived from the district near Las Vegas, in Clark County, Nev., and known locally as the Las Vegas manganese field. However, development here has disclosed ore beds of some magnitude, and the district gives promise of becoming one of the most important sources of manganese ore in the United States.

The new district is situated in the southern extremity of the Muddy Mountains, about five miles west of the Colorado River and 16 miles east of Las Vegas, Nev. The south end of this range is composed largely of intrusives and volcanic tufa, the main intrusive, forming the bulk of the range, being rhyolite, occasionally cut by large dykes of basic gabbro. There is much evidence of comparatively recent volcanic action, evidently responsible for the tufa, and basic lava flows are frequent. Some highly altered sedimentaries were also noted, including quartzite and marbleized limestone. The foothills of the range, in which all of the known ore deposits occur, are composed largely of consolidated gravels of Pleistocene age, with frequent large masses of impure gypsite and some serpentine in vicinity of intrusives.

The largest producer in the district is the Three Kids claim, which was the original discovery made early in 1917 by Bob Edwards, a local prospector. Soon after the discovery, the property was leased to Messrs. Gillice, McCoy and Connors, who later formed the Manganese Association, which is now operating it. During the first three months of 1918, the property produced approximately 5000 tons of ore, and is now shipping 150 tons daily, with expectation of 300 tons daily in the near future.

On the Three Kids claim, the ore occurs as a large lenticular mass which outcropped near the base of the

*Goodsprings, Nevada.

foothills adjacent to a broad flat wash. An opencut about 200 ft. in length has exposed a face of ore averaging about 25 ft. in thickness, with the footwall not yet definitely determined. Churn-drill holes at regular intervals indicate a thickness of over 40 ft. in the vicinity of the opencut. The lateral extent of the deposit is not definitely known, but apparently it covers an area at least 500 ft. square, and outcroppings on the hillside above and in the wash to the west indicate that it may be of far greater extent. However, it is not expected that the thickness of 40 ft. will obtain throughout, as churn-drill holes indicate a decreased thickness toward the extremities.

The deposit is distinctly stratified, the ore beds striking N 50° W, and dipping about 15° northeasterly. A series of step-faults striking nearly north and south have displaced the beds to some extent, but in no case more than a few feet, the west block, in each instance, being down-thrown. On the west extremity of

EDGE OF ORE LENS, LOWNEY MANGANESE ASSOCIATION, CLARK COUNTY, NEV.; HANGING WALL IS GYPSITE AND FOOTWALL RHYOLITE

the exposure is a large dyke of gabbro, apparently about 150 ft. thick, and striking northerly. The material overlying the ore bed, or the overburden, consists of gravels and detritus, more or less consolidated and varying in thickness from three to 15 ft. Interspersed between the strata of the ore bed are occasional layers of granular quartzose material, from a few inches to two feet in thickness. The rock underlying the bed has not been exposed, but churn-drill holes indicate that it is the rhyolite of which the range is largely composed.

Ore Mainly Psilomelane and Pyrolusite

The ore is a soft black material, of unusually low specific gravity and of a porous oölitic structure. Apparently it is composed largely of psilomelane and pyrolusite, although parts of the deposit may be classified as wad. The ore is fairly uniform in texture, but under the microscope shows granules of botryoidal and concentric structure, embedded in a matrix of soft powdery ore. The average content of the first 31 carloads derived from the Three Kids opencut, and which may be considered as typical of the deposit, is as follows: Mn, 41%; SiO_2, 11%; P, 0.03%; Fe, 1%; moisture, 11.62 per cent.

Quarrying methods are used for mining this deposit, the ore being broken by means of churn-drill holes and black powder. The ore is very friable and has a tendency to break in large blocks, which are subsequently broken up with hand axes. The finer material, which frequently contains some of the granular silica, is "forked" or shoveled into cars with heavy forks having 1-in. openings which allow the fine silica to pass through the tines, this material being rejected. The ore is hoisted over an inclined tramway into bins of 500 tons' capacity, and is hauled to Las Vegas in motor trucks.

Rhyolite Footwall on Lowney Property

Across the wash from the Three Kids property, and about 1500 ft. distant, is the Lowney property, now being operated by the Lowney Manganese Association. The geologic conditions on this claim are similar to those of the Three Kids deposit, except that the ore strata have been tilted much more, so that they dip about 45° northeasterly, striking about N 40° W. The outcrop on this property was small, consisting of only a few inches of ore, apparently an extremity of the original lens. The deposit has been explored by an opencut, which, however, disclosed the lens at a depth of only 20 ft., at which point it is about 4 ft. in thickness. Adjacent to the cut, a shaft, now 60 ft. deep, shows the lens to be 8 ft. in width at this depth, which width the lens apparently maintains throughout a 50-ft. drift at the bottom of the shaft. Underlying the lens is a smooth rhyolite wall, apparently similar to the footwall of the Three Kids deposit. On the hanging-wall between the lens and the overlying gravel beds is a 4-ft. stratum of impure gypsite in contact with the ore. The ore is exactly similar to that described above, and varies in manganese content from 38 to 48%. To date, no shipments have been made from this property, but a considerable tonnage has been extracted, and shipments will begin in the near future.

Westerly from the Lowney property, extending along the foothills at approximately the same horizon, numerous outcroppings of manganese ore were noted for a distance of about three miles. These outcrops are all under location and are being developed to some extent, the more favorable locations being the Las Vegas, Surprise and Mistake claims. About two miles east of the Three Kids property a promising outcrop has been located under the name of the Hard Scramble and is undergoing development. All of these outcrops present geologic features similar to the deposits described, and while it is evident that many of them will not prove to be of importance, it is also to be expected that development will disclose other lenses of sufficient magnitude to be operated profitably.

Origin of Deposits in Doubt

At this date, owing to the meager development of the manganese ore deposits of this district, their genesis is somewhat problematical. It seems beyond question that the manganese oxide ores are of sedimentary origin, having been laid down prior to the Pleistocene strata overlying the ore beds. It is not unlikely that the original source of the manganese lies in the gabbro intrusives found in the vicinity, and that the ore was originally a replacement in sedimentary rocks, being deposited as a manganese silicate, or a mixture of man-

ganese carbonate and silicate, which was subsequently altered to the oxide forms. In this case, the ore lenses would be residual deposits, from which many of the original elements have been leached, but it must also be considered that the oxide ores may have migrated a considerable distance from the original deposit, which appears probable. To date, no manganese silicates or carbonates have been discovered, but it is expected that development will disclose important facts as to the genesis of the deposits.

In view of the extent of the new district and the large size of the deposits so far explored, compared to other known deposits in the United States, it would appear that the future promises an important manganese-ore industry for southern Nevada. At present, physical conditions are somewhat disadvantageous, the district being 16 miles from rail, but it is probable that a railroad will be constructed in the near future. Fortunately, the topography of the intervening country is such that this can be done at reasonable expense.

From a practical standpoint, the ores of the district are suitable for smelting purposes, on account of their low phosphorus and iron content, while certain physical characteristics make them especially desirable for blast-furnace practice. Under present market conditions, 40% manganese ore will bring $25 per long ton, f.o.b. Las Vegas. Mining costs do not exceed $2 per ton, and haulage to Las Vegas by motor truck costs $5.50 per ton, so that, with proper allowances for moisture, etc., the margin of profit is approximately $15 per long ton, which will be materially increased when better working conditions are obtained.

Alaskan Chromite Deposits

Deposits of chromite, known in Alaska for a number of years, became of economic interest only in 1917, when the relatively high price of the ore recalled them to the attention of mining men, with the result that ore is commercially mined at one property.

Chromite deposits of present economic interest, according to the United States Geological Survey, are at the southwest end of Kenai Peninsula, in two areas, one along the north shore of Port Chatham and the other at Red Mountain, about 16 miles to the northeast. Both deposits occur in bodies of altered peridotite, and, so far as known, these are the only bodies of peridotite in this vicinity, but exploration farther from the coast, in the mountains, may reveal others. Peridotite of the same kind also occurs in large and small masses at several other places in the area between Yukon and Tanana rivers, and at Livengood, in that area, there is a deposit of chromite, but the ore in the interior of Alaska could not be mined profitably except when high prices prevail.

The chromite of southwestern Kenai Peninsula occurs in lens-shaped bodies that range in thickness from a few inches to 20 ft., and that lie in attitudes ranging from horizontal to vertical. None of the lenses appear to be more than 150 ft. long, and most of them measure considerably less. The ore is not of uniform grade. Some of it averages 50% chromic oxide, and some is a mixture of chromite and peridotite, the leanest part of which may yield only 5 to 10% chromic oxide. All gradations between these extremes are found.

The deposit now being mined is on a spit at the southeast end of a peninsula known as Claim Point, which projects southeastward into Port Chatham. This peninsula measures about 4000 ft. from east to west, and about 2200 ft. from north to south, and is joined to the mainland by a neck of land about 200 ft. wide. The rock of Claim Point is entirely peridotite, which crops out also on the mainland to the north and continues southward into Port Chatham for an unknown distance. The known area of peridotite here covers about three-fifths of a square mile. The orebody is nearly covered by water at high tide, so that mining must be done between low and half tide. The deposit is a vertical lens, having a length of about 100 ft. and a maximum width of 20 ft. Approximately 800 tons of ore containing from 46 to 49% chromic oxide was mined in 1917, and as much more remains in sight above half tide. Ultimately it will be necessary to work from a shaft or cofferdam and hoist ore to the surface, so that the cost of mining will be increased.

Probably the upper half of the deposit has been removed by erosion. If so, and if the deposit becomes thinner downward for 50 ft. and the ore has a specific gravity of 3.9, only 4000 or at most 5000 tons remains below the level of half tide.

Several other lenses of high-grade ore, none more than three feet thick, occur in this vicinity, as well as a number of bodies of low-grade ore ranging in thickness from 5 to 20 ft. and varying in their content of chromic oxide from 5 to 15%. At one point on the north side of Claim Point, near the crest of the peninsula, there are four lodes that stand nearly vertical, and the owners are considering the feasibility of driving a tunnel from a lower point on the hillside to crosscut them. These four bodies should produce, when concentrated, about 3000 tons of 50% ore, but it is likely that the tunnel contemplated might also reveal other deposits. There should be available at Claim Point at least 15,000 tons of chromite ore of a grade containing 50% of chromic oxide after concentration.

Freight from Port Chatham to Seattle is $3.50 a ton, and from Seattle to an Eastern smeltery is about $12 a ton, to which must be added the cost of lighterage to the steamship anchorage in Port Chatham or lighterage to the wharf at Port Graham.

The body of peridotite at Red Mountain is larger than the deposit at Claim Point, but is less accessible, and the grade of the ore there is not so well known. The peridotite covers about three square miles and contains many stringers and lenses of chromite ore, both high and low grade. The largest deposit observed was a lenticular body of high-grade ore not more than 75 ft. long, that had a maximum thickness of eight feet at the center and contained probably not over 1000 tons. At this place there are many other smaller deposits and perhaps some as large or larger, all of which should yield at least as much chrome ore and possibly several times as much as the body at Claim Point. On the other hand, these ores occur at an elevation of about 3000 ft. and at a minimum distance of six miles from tidewater, from which much of the route lies through a precipitous and densely vegetated country. In winter the ore might be sledded out to tidewater, but in summer it would have to be carried by a tram.

Manganese Washing Plant of the Eureka Company, Arkansas

By Tom Shiras*

The concentration or washing of manganese ore, which occurs in small nodules or grains disseminated through the residual clay beds left by the decomposed St. Clair lime, in the Batesville, Ark., field, is being accorded considerable attention. Estimates by a number of engineers place the fine disseminated ore at one-half of the available supply. A large tonnage of this class of ore is now lying on the old mine dumps, not having been utilized, on account of the lack of washing machinery. At no place are these deposits more than 1½ miles from water supply.

The Eureka Manganese and Mining Co. is working exclusively on low-grade ore, and in 1917 installed the first modern washer in the field. The property consists of a 343-acre lease situated six miles northeast of the shipping point, Cushman, near Polk Bayou, a swift-flowing mountain stream which affords a superabundance of water for washing purposes.

WASHING PLANT OF EUREKA MANGANESE AND MINING CO.

MANGANESE ORE IN ORE YARD AT CUSHMAN, ARKANSAS

The deposit is mined as an opencut. The cut is 200 ft. wide and 30 ft. deep and has penetrated the orebody for a distance of 50 ft. There are two levels, the upper being 15 ft. higher than the lower. The equipment consists of 300 ft. of track, including surface track to the waste dump, and five self-dumping mine cars. Not including the shallow mantle removed in stripping, the average mine recovery has been one ton of marketable manganese to 5 cu.yd. of manganese-bearing clay. Ground is broken mostly by pick and shovel, the use of explosives being necessary only to a limited extent. Owing to the scarcity of labor, a steam shovel is to be installed. This will double or treble the output of the mine and maintain the operation of the washing plant at full capacity. A heavy-timber-constructed tramway starts from the lower level of the mine and has a gentle grade for a distance of 80 ft., but rises to a point 40 ft. above a revolving screen at the head of the washing plant. The screened product is discharged on a belt conveyor which delivers to a bin.

The tipple is installed above the washing plant and the clay ore is dumped into the 30-cu.yd. bin. From this bin, the ore passes over grizzly bars set 3½ in. apart. The undersize passes to a log washer below the grizzly.

The washing plant is equipped with a McLanahan-Stone two-log washer. The logs of this washer are 30 ft. long, and each has 84 lugs, or heavy cast-iron paddles attached by heavy lagscrews. The effect is to make each log a revolving spiral conveyor. The logs are inclined at a pitch of one inch rise per foot of length, which gives the wash water a backward flow sufficient to carry off the mud and sand thus agitated and held in suspension, while the heavier manganese settles to the bottom of the conveyor and is discharged at the upper end into what is termed the slush trough. The gross weight of these logs and lugs is five tons, and they have a speed of 20 revolutions per minute.

From the log-box discharge, the washed ore passes to a 16-mesh revolving screen, 8 ft. long and 40 in. in diameter, and is sprayed with water under heavy pressure by 1½-in. perforated pipes, inside and outside the trommel. This gives the undersize a further cleaning of sand and clay.

From the screen the undersize passes to a 30-in. belt, where it is conveyed 60 ft. to a double ½-in. mesh screen, set at an angle of 45° over a 120-ton storage bin. At this screen the product is automatically separated into what are classified as coarse and fine grades.

The water supply is at Polk Bayou, at a point 4500 ft. from the plant. The water is delivered by a Worthington-Duplex pump, through a 4-in. pipe, to a reservoir of 70,000-gal. capacity situated on a hill at an elevation 50 ft. higher than the plant and 210 ft. above the source of supply. A 65-hp. boiler serves the pumping plant. The washing plant normally requires 200 gal. of water per minute.

From May 1, 1917, to the first week in April, 1918, the Eureka Manganese and Mining Co. marketed 2300 tons of manganese ore. A close record of production from May 1, 1917, to Jan. 1, 1918, showed that 8630 tons of crude ore were mined and washed, which yielded 1771 tons of washed ore averaging 42½% manganese. Besides the mine producing at present, there are two other orebodies on the property easily made accessible to the mill by the installation of tramways, which the company thinks will insure ore for at least three years' operations at a rate of output even greater than is possible at present.

*Mountain Home, Arkansas

The Manganese Deposits of South Wallingford, Vermont

BY ROBERT W. JONES*

The interesting deposit of manganese ores at South Wallingford, Vt., has frequently been brought to the attention of geologists and engineers, although in later years there has been no serious attempt to make a production of these ores. The deposit has been opened a short distance east of South Wallingford, along the west face of Green Mountain and apparently at the contact of the limestone (marble) and the quartzite. Green Mountain consists almost entirely of a dark bluish quartzite, carrying in irregular parallel beds a rather heavy percentage of finely divided pyrite. Alternating with the pyrite deposits are small local quartzite beds carrying a high percentage of mica and feldspar grains. A heavy glacial deposit obscures the geology of the beds, and through lack of available underground work it is difficult to state the exact relationship of the various ores.

The region has undergone heavy metamorphism. Marbles, graphitic schists, mica schists, and quartzite are exposed with somewhat uncertain evidences of local metamorphism. Chemical decomposition of the preceding rocks has occurred in local areas to such an extent as to obscure the bedding.

The original property was opened about 1820 for the production of limonite, the ore being smelted locally and the finished product taken to Troy, N. Y. After rather extensive operations, production ceased until about 1887, when further exploratory work was undertaken, with a considerable production of both iron and manganese minerals. About 1903 the property was again opened, but ceased to operate after a short period of activity. The present owners are undertaking exploratory work through the opening of several new adits so directed as to cut the ore at apparently a higher level. Several hundred feet of crosscutting has been accomplished. The original workings at a lower level are rather extensive, there being about 2000 ft. of drifts, raises, etc. These workings have caved badly, and would require considerable time and money to again place in condition.

From the most westerly opening, the material exposed underground occurs in the following order: a white siliceous kaolin with small stringers of magnesian silicates and rather heavy beds of an almost pure quartz sand; a siliceous kaolin heavily stained with limonite to such an extent as to produce a good grade of ocher, when washed; decomposed mica schist; limonite more or less decomposed into a soft sandy material, although carrying pockets and stringers of high-grade material; umber alternating with ocher and carrying undecomposed manganese minerals.

While this property is of considerable interest as a possible producer of manganese, it is also of great interest in respect to the various products of rock disintegration. The presence of a heavy flow of water available for milling purposes gives possibilities to the region for the production of white clay of apparently high grade.

A sample of clay taken from the present workings was passed wet through a set of screens up to and including 200-mesh. The finer material was then passed through a modified Schultze elutriation apparatus with a flow of 200 c.c. per minute. The material not passing the 200-mesh consisted of 15.04% of the total and was made up of clear quartz fragments more or less cemented by a siliceous bond. Cone 1 of the Schultze apparatus returned 10.08% of the total with the same composition as the preceding excepting a trace of kaolinite. Cones 2 and 3, with a total of 34.52%, gave 45% and 65%, respectively, in kaolinite. The overflow, consisting of the remainder of the sample, carried 85% kaolinite. The above determinations of kaolinite are by grains or fragments. The only other constituent found was quartz in finely divided grains.

An analysis of the crude material gave the chemically combined water as 5.48%, with silica, 67.20% and alumina, 27.28%. While the combined water was low, the analysis indicated the presence of from 65 to 70% kaolinite. There were no iron minerals present. The disintegrated mica schist of course carried the iron minerals with a heavier percentage and showed little kaolinite except in the overflow. This carried less than 40% kaolinite, according to the chemical analysis. With the ocher, about 25% of the sample was found in the overflow. Of this, 80% consisted of kaolinite with a heavy coating of limonite. A selected manganese ore analyzed close to the limit of the pure material and low in objectionable materials.

Water is abundant, in fact so abundant as perhaps to cause some annoyance in mining. The property is so situated as to be able to take advantage of a natural fall in washing. Rail transportation is available with a haul of less than a mile.

*Mining engineer and geologist; 17 Magnolia Terrace, Albany, New York.

Manganese Prospects in Eastern Cuba

While several hundred manganese mining claims have been filed during the last year at the mining bureau of the province of Oriente, Cuba, writes Consul H. M. Wolcott from Santiago, in only a small number has it been demonstrated that they may be operated at a profit, even with the present abnormally high prices paid for the ore. The lack of proper transportation facilities and of good roads is the great drawback to the development of the industry here. With three exceptions, the mines have to haul their ore to the railroad in ox carts and mule carts, or by pack mules, for a distance of three to 15 miles, and at a cost of $3.50 to $10 a ton.

As most of the ores are of low grade and practically none come up to the standard of 48% manganese, it is difficult to operate at a profit under existing conditions. The roads that are available during the few months of the dry season become practically impassable in the season of abundant rainfall, which usually occurs from April to November. Some of the American mine operators are now introducing motor trucks and tractors for transportation of the ore, and it is hoped that by this means some of the present difficulties may be overcome.

The manganese mines or claims of the province may be divided into nine groups—Cristo, Ponupo, San Nicolas, Palmarito, Los Negros, Santa Rita, Guisa,

Sabanilla and South Coast—the most important of which are the Ponupo and Cristo.

The Ponupo group produces at present about 5000 tons of ore a month. It is chiefly low grade, averaging from 38 to 40% manganese, and is rather low in silica and iron. As this group is near the line of the railroad, the ore is mined and shipped at a profit under present prices.

The Cristo group consists of several small claims, which at present produce approximately 4000 tons of ore monthly. The ore runs slightly higher in manganese and about the same in silica and iron as the Ponupo ore, but it requires washing.

The Palmarito and Los Negros groups produce each about 1000 tons monthly. The ore from them is high grade and very low in silica and iron. Considerable modern machinery has recently been installed at the San Nicolas mines, and it is expected that several thousand tons monthly will soon be produced from this group.

The remaining four groups have a combined monthly production at present estimated at 1000 tons, making the total for the province approximately 12,000 tons monthly, all of which is exported to the United States through the ports of Santiago and Nipe.

The declared exports of manganese ore from the Province of Oriente in 1917 were valued at $567,849, of which a large proportion was shipped through the port of Santiago de Cuba, and the remainder from Antilla (Nipe).

The Occurrence of Tungsten in Manganese Ore

BY WALTER S. PALMER*

About two years ago, during the high price of tungsten, samples of manganese containing tungsten ore were submitted to me. The samples came from near Mina, Nev. The manganese minerals present were psilomelane and pyrolusite associated with quartz of the variety called common opal. In testing the samples, it was noted that the tungsten could not be concentrated, in fact no distinct concentrates could be produced; the last material left in the pan often gave poorer qualitative tests for tungsten than the original sample. The manganese minerals and the quartz in the samples were about equally divided. No quantitative determinations for tungsten were made.

During the course of investigations now being conducted on manganese, ores showing somewhat similar association have been received from widely different parts of Nevada. I cannot find in the literature on tungsten any reference to similar occurrences. The nearest reference to such I find in Bull. No. 652 of the U. S. Geological Survey, where on p. 28 mention is made of the association of tungsten with manganese as wolframite coated with manganese dioxide.

The first of the recent samples came from Sodaville, Nev. The specimen differed considerably from that received from Mina. It contained large crystals of calcite, easily observed on a fresh surface, through which was scattered the manganese mineral. A partial analysis of this specimen gave the following results:

*Professor of metallurgy, University of Nevada, Reno, Nevada.

Manganese (Mn), 28.28%; tungstic acid (WO_3), 2.4%; iron (Fe), 3.25%; insoluble residue, 4.4%. The tungsten could not be concentrated by panning.

The second samples were sent in from a locality some distance from Tonopah. One of these samples resembled the Sodaville ore in its association with calcite, while the two others submitted consisted of massive psilomelane. The following partial analyses show relative amounts of manganese and tungsten:

ANALYSES OF NEVADA MANGANESE AND TUNGSTEN ORES

	Manganese Per cent.	Insoluble Residue Per cent.	Tungstic Acid Per cent.
Pyrolusite and Calcite	13.3	11.6	1.0
Psilomelane	39.2	2.0	3.05
Psilomelane	43.2	10.6	1.1

It is noticeable that in all of these samples the tungsten could not be concentrated by the usual gravity methods. Specimens were polished and etched for microscopic determination, but no further light was thrown on the possible form in which the tungsten occurs.

Copper Amalgam as Cement

The following method of preparing Vienna metal cement (a copper amalgam) was reprinted from *Giesserei Zeitung* by *Journ. Ind. and Eng. Chem.* in its January issue:

A strip of zinc is placed in a solution of copper sulphate and the powdery copper which is precipitated is put into a mortar and kneaded with mercurous nitrate, mercury and water into a plastic paste; three parts copper are used to seven parts mercury. When metals are to be cemented with this amalgam, which is brought into the market in small cylinders, the parts are polished and heated up. The amalgam is heated also to 80 or 90° C. and the parts are pressed together. The amalgam itself can be hammered, rolled and put under a die; it takes a good polish. Placed in boiling water, it softens sufficiently to use it as a material for taking casts. It is rolled into a thin strip, which is applied to the heated object. The replica obtained is afterward backed with type metal.

Your Fifty-Dollar Liberty Bond

It will protect 1000 soldiers from smallpox and 666 from typhoid. It will assure the safety of 139 wounded soldiers from lockjaw, the germs of which swarm in Belgian soil. It will render painless 400 operations, supply two miles of bandages—enough to bandage 555 wounds. It will care for 160 injuries in the way of "first-aid" packets. It will furnish adhesive plaster and surgical gauze enough to benefit thousands of wounded soldiers. Every purchaser of a Liberty Loan bond performs a distinct individual service to his country and to our boys fighting in France.

South Lake Mining Co.—Between May, 1916, and Dec. 31, 1917, 68,388 tons of rock were sent to the mill and 754,433 lb. of refined copper, 11.03 per ton, were produced. Expenses for 1917 were $218,113.42 and income was $121,037.11, leaving an excess of current liabilities of $97,076.31.

You must buy or pay—buy a Liberty Bond or pay Germany.

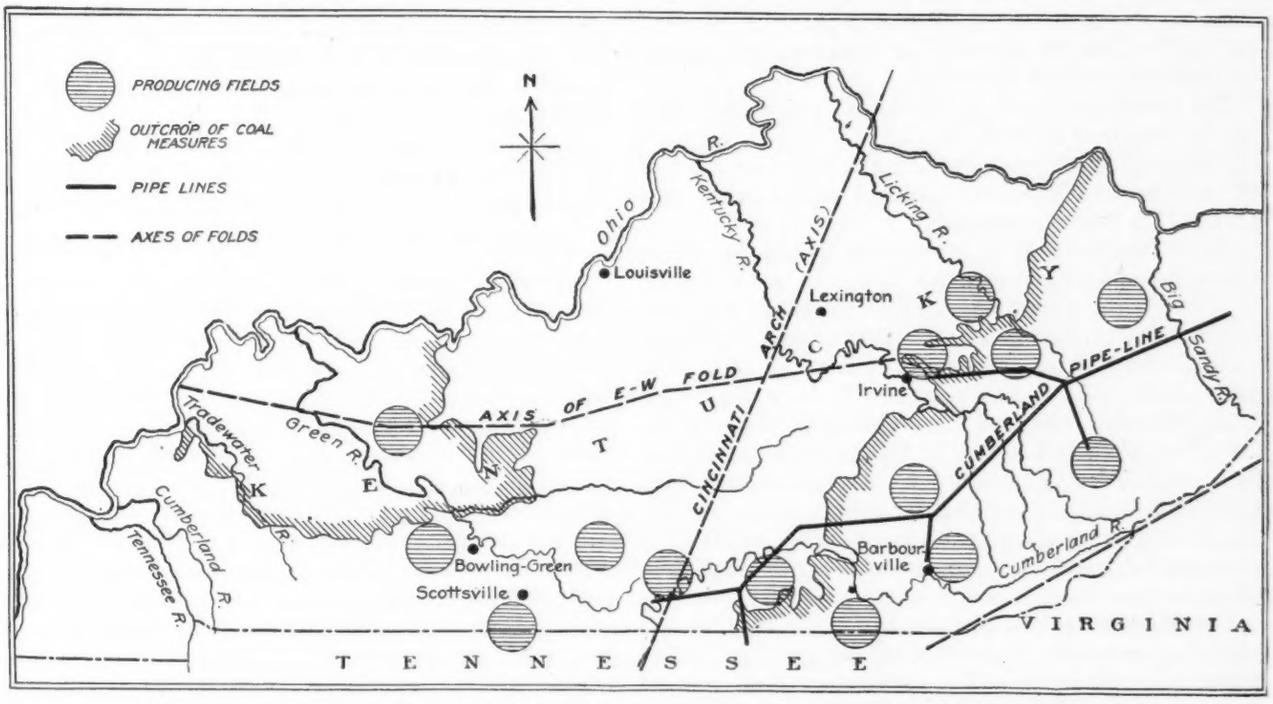
The Kentucky Oil Fields

By W. N. THAYER*

Of the eleven formations in the Paleozoic group, the Corniferous is the most important as an oil producer. Some of the other formations show oil-bearing sands; deposits of asphaltum are present in the Conglomerate Measures, and the Black Shale formation produces gas. Kentucky oils are of a paraffin base and are marketed in two grades. Topographical conditions have retarded the field work essential to proper exploration, although considerable drilling has been done.

THE recent decline of some of the older oil fields, coincident with an increased demand for petroleum products, has given considerable stimulus to the search for new producing districts. Among those recently exploited are areas in Wyoming and Kentucky, and opinion is prevalent among well-informed persons that these states must supply a large part of the needed increase in oil production. The Wyoming fields have already received considerable publicity, but Kentucky, with its less spectacular production, has achieved small recognition as a possible oil producer. The present oil production of Kentucky is limited to a few counties, as shown by the accompanying map, but areas which may be classed as potential oil fields are distributed over the eastern, southern, and western parts of the state, and the more or less concentric manner of distribution is controlled by certain major structural features.

Kentucky embraces parts of three physiographic divisions, namely: the Cumberland-Allegheny plateaus, the interior low plateaus and the Mississippi embayment section of the Gulf Coastal Plain. It has, in consequence, a variety of topographic features. East of a line drawn from the western edge of Greenup County on the Ohio River to the western edge of Wayne County on the Tennessee border the surface features are those of the maturely dissected Cumberland-Allegheny plateaus. The topography is rough and mountainous, the hills rise to altitudes approaching 2000 ft. and the generally even sky line, as observed from any of the elevations, is unmistakable evidence of a former peneplain. An area of 500 square miles may have a total relief of 1000 or 1200 ft., and in places the local relief is from 600 to 800 ft. per mile. Where stratigraphic conditions are favorable, the local relief may be expressed in part by almost perpendicular cliffs. A heavy growth of dense timber subdues the relief and tends to make the topography less rough than it appears to be.



MAP OF KENTUCKY SHOWING PRODUCING OIL FIELDS AND OUTCROPS OF COAL MEASURES

West of the line, the surface contour is entirely different. The topography is not as rugged, and, although carved from an uplifted peneplain, the evidence of former base-leveled conditions is less apparent. The highest hills reach elevations of 800 or 900 ft., and the maximum local relief seldom exceeds 300 ft. per mile. In the Mississippi embayment section, between the Tennessee and Mississippi rivers, the topography is still more gentle, and, in places, quite featureless.

The stratigraphy of Kentucky is simple, but a multiplicity of formation names, some of them synonyms while others have been borrowed by drillers from adjoining states and erroneously applied, is likely to cause confusion when one tries to correlate oil-well data. The names used in this paper are chiefly those adopted by the Kentucky Geological Survey and are shown in

*Consulting geologist, Cincinnati, Ohio.

the correlation table accompanying the generalized stratigraphic column for the state. All of the rocks appearing at the surface, excepting the small igneous dikes of Elliott County, are of sedimentary origin. In the Mississippi embayment section they are of Cretaceous and later age. In the remainder of the state they are included in the Paleozoic group and embrace all the formations from the Trenton to the coal measures.

Characteristics of Kentucky Formation

The Trenton rocks are limestones and dolomites almost exclusively. They have a vertical thickness of about 600 ft.[1] and outcrop in a roughly circular area around Lexington on the eroded top of the Jessamine Dome. Above the Trenton limestone and up to the Chester, the strata outcrop in a concentric manner around the Jessamine Dome. The Hudson consists chiefly of limestones and shales, with an occasional sandstone member. In the central part of the state, where the formation has its greatest development, the thickness is about 600 feet.

The Clinton, consisting of a series of dolomitic and cherty limestones, shales, and a thin band of iron ore, underlies a large area and is about 50 ft. thick, but drill records indicate an increase in thickness toward the southeastern part of the state.

The Niagara consists of limestones and shales varying in thickness from 15 to 100 ft. The shale phase has its greatest development along the western edge of the Cumberland-Allegheny plateaus and further east grades into heavy limestones.

The Corniferous is a magnesian limestone which varies in thickness from a few inches to more than 50 ft. Where the limestone outcrops it follows the concentric lines of the other formations around the Jessamine Dome, but under cover it is wanting in several parts of the state or indistinguishable from the underlying Niagara limestones. The absence in places of the Corniferous formation and its irregular thickness may be accounted for by assuming an erosion unconformity between it and the overlying formation, an assumption for which there is considerable basis. The formation is resistant to weathering, and its outcrop is marked in places by prominent bluffs.

The Black Shale is a bituminous formation, generally black, from which it derives its designation, but in places white or brown. The thickness varies from 20 to more than 600 ft., being greatest in the extreme eastern part of the state. On account of its color the shale is a prominent key bed, and easily recognized by the driller.

The Waverly group includes all the formations from the top of the Black Shale to the base of the St. Louis limestones, and generally consists of a series of sandstones and sandy shales, but in places is represented by dark limestones and calcareous shales. The thickness varies between 300 and 500 ft., and the outcrops are distributed over a larger area than any of the other formations.

The St. Louis group consists almost exclusively of limestones and is of variable thickness, but shows a progressive increase toward the southwest. In some of the eastern counties the beds are less than 20 ft. thick, whereas in Breckenridge County they are more than 700 ft. The formation is nearly always found in place, and, next to the Black Shale, is probably the most easily recognizable horizon to the driller.

The Chester group consists of a series of limestones, shales and sandstones. On the map issued by the Kentucky Geological Survey the formation is not distinguished from the St. Louis group, and in the eastern part of the state it is only a few feet thick, although increasing rapidly toward the west and southwest and attaining a thickness of 800 ft. in places.

The Conglomerate Measures (a name used by the Kentucky Geological Survey to designate the series of elastic sediments extending from the top of the Chester to the base of the Allegheny) form the surface of a large area along the western edge of the Cumberland-Allegheny plateaus and around the southern extension of the eastern interior coal basin. This area consists of shales, massive and thin-bedded sandstones, and true quartz-pebble conglomerates and also carries important seams of coal. Along the eroded edge of the plateau the formation is less than 100 ft. thick, but further east it attains a thickness of more than 1000 ft. Massive sandstones form prominent features of the topography. The thickness of this formation has not been determined in the areas occupied by the coal basin in the western part of the state.

The coal measures, as well as the Cretaceous and later sediments, contain no oil horizons so far as known at present, so discussion of them is not here included.

Flat Structure Marked by Anticlinal Folds

In general, the strata of the state lie flat. There are, however, certain structural features of importance, the most prominent of which is the Cincinnati Arch, an anticline striking a little east of north. This fold reaches its maximum development in the vicinity of Lexington, and is generally referred to as the Jessamine Dome. There are also a few folds of secondary importance, among which may be mentioned the Rough Creek anticline, that strikes a little north of east across the eastern interior coal basin, and the Warfield and Sandy Hook anticlines, in the eastern part of the state, each striking a little north of east. These latter folds are probably extensions of the former; in fact, the Jessamine Dome appears to be the result of the intersection of the east-west fold with the Cincinnati Arch. The Pine Mountain uplift, in the southeastern part of the state, is another fold of secondary importance.

Outcrops Evident on the Jessamine Dome

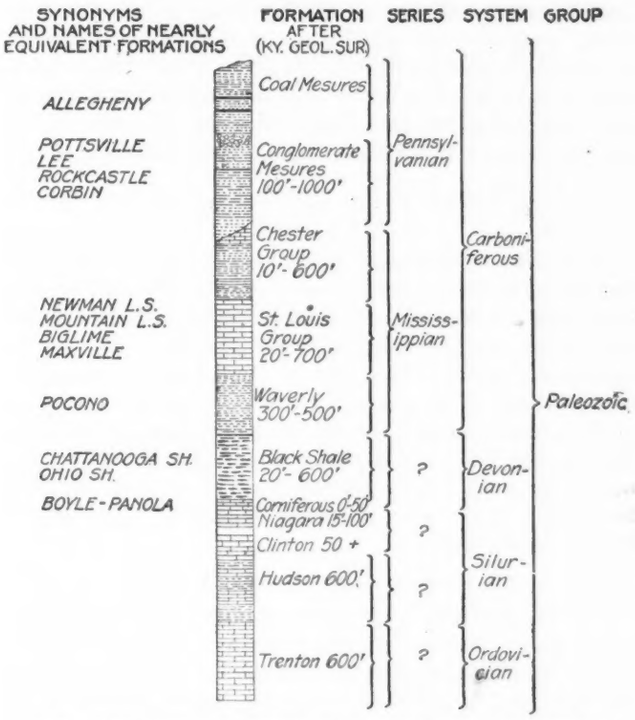
The Cincinnati Arch controls the regional dips of the rocks over a large part of the state, and the Jessamine Dome brings the formations to the surface in the central part of the state and produces outcrops of concentric bands. The regional dips are gentle and range from 20 to 50 ft. per mile. They are too low to be read directly, but they may be determined by plotting the elevations of certain formations at various points, and their effects are observable in the outcrops of successively younger rocks as one goes eastward or westward from the axis of the arch.

In addition to these larger structures, and frequently imposed upon them, are numerous anticlines, monoclines and synclines which in some cases parallel the

[1]Bull. No. 1 of Kentucky Geological Survey, "The Oil and Gas Sands of Kentucky," by J. B. Hoeing.

larger folds, but in general show no uniformity of strike. Their widths may vary between a few hundred feet and a few miles, and the dips of the limbs are generally less than 15 degrees. The folds are post-Pennsylvanian in age and the deformation that produced them was probably coincident with the general uplift and folding of the Appalachian region. Faults are common, of slight throw and parallel the larger folds. With few exceptions the topographic effects are seldom noticeable, but in places they may have an important bearing on the accumulation of petroleum.

The Trenton formation, although a prolific producer in Ohio, has not as yet been sufficiently productive in



STRATIGRAPHIC COLUMN FOR PALEOZOIC GROUP IN KENTUCKY

Kentucky to justify the deep drilling necessary to reach it in most parts of the state. Along the Cumberland River, where it is easily reached, the formation carries one fairly constant oil sand, the lower Sunnybrook. Wells drilled into this sand several years ago gave a large initial production, but the flow was of short duration.

The Hudson carries two oil sands, the upper Sunnybrook, near the base, and the Caney, near the top of the formation. Neither has had any considerable flow, but the Caney is apparently the better producer of the two.

Clinton Sands Have Produced Little Oil

The Clinton, though drilled through in many places with frequent shows of oil and gas, has not yet been proved to carry any sand of great lateral extent or productiveness, although in Morgan County it has produced a small quantity of high-grade oil. The Niagara is without oil horizons, except possibly the Boyd's Creek sand of Barren County.

The Corniferous is probably the most important oil-bearing formation in the state, and is the source of the greater part of the present production. It is the reservoir in the well-known Irvine and Ragland oil pools and the Menefee County gas pool, and recent drilling has proved it to be oil-bearing in many other parts of the state. The "pay" is apparently to be found at various depths below the top, but it is probable that careful correlation of well data will show that the formation carries one definite oil-bearing sand not far from its base.

Black Shale Has Produced Gas

The Black Shale, although highly bituminous and containing numerous oil seeps and springs along its outcrop, is not a productive formation. Its general character has induced a great deal of prospecting, not alone for oil, but for coal as well, although without success. Recent experiments[2] have shown the shale to be capable of yielding 5 to 10 gallons of oil per ton upon distillation. Economically this fact is not at present important, but it may have some scientific importance, inasmuch as it suggests a possible origin for the oil in the underlying formation. In Meade County, the Black Shale produced sufficient gas to justify piping it to Louisville.

The Waverly group carries eleven recognized oil sands, but none appears to be constant over large areas. Near the top of the formation are the Big Injun, Keener, and Squaw sands, which, in several of the southeastern counties, have produced some oil and large flows of gas. Further down in the formation the Cloverport gas sand of Breckenridge County contained a long-lived pool. In Wayne County the Waverly group carries seven sands. Of these, the Stray, Mount Pisgah, Beaver, Otter, Cooper and Slickford have produced large quantities of oil and some gas. In the eastern part of the state the Berea sand lies close beneath the Big Injun group. This has been a good producer in Ohio, but in Kentucky it has not been sufficiently tested to prove its worth.

Asphaltum Deposits Show in Outcrops of Conglomerate Measures

In the eastern counties the Conglomerate Measures carry several sands of variable thickness and of indefinite lateral extent, locally known as Beaver, Horton, Pike, Salt, Wages, Jones and Epperson. In several places these sands are good producers of high-grade oil. No oil sands have been recognized in this group in the western part of the state, but deposits of asphaltum at several places along the outcrop suggest the possibility of pools having the proper structural conditions for oil producers.

Kentucky oil is generally of paraffin base. Its color varies from light green to brown or black, and the density between 25° and 40° Bé. It is marketed as two grades, light and heavy, known as Somerset and Ragland respectively. The greater part of the oil produced is of Somerset grade.

The comparatively low cost of drilling a test well in Kentucky has induced considerable prospecting in nearly every county of the state, chiefly by individuals of limited means and in the majority of cases with total disregard of geologic conditions. There is a prevalent opinion that oil will be found anywhere "if one goes deep enough." The equally erroneous opinion that oil found on one property will also be found on adjoining

[2]Eugene W. Shaw. Bull. 661, U. S. Geol. Surv.; pp. 141-191.

properties is also held by many, and thousands of acres have been traded on this basis.

During the last two years several of the larger operators have had corps of geologists in the field mapping structure, and their example is beginning to be followed by the smaller operators. At present, numerous pseudo-geologists, self-styled oil experts and divining-rod specialists are in the field, giving advice which is so generally wrong that the well-trained professional geologist frequently finds his ability discounted. This condition is not peculiar to Kentucky, but is apparently more aggravated there than elsewhere.

Many Factors Make Geological Work Difficult

The work of a geologist in Kentucky is difficult at best. The roughness of the topography in most places, the interference of the forest cover with long sights, the scarcity of reliable key beds in the great thicknesses of sandstones and shales, and the inaccuracy of most of the available well logs contribute to the difficulty of making good structure maps. Moreover, suitable base maps are seldom available. In a few places the Kentucky Geological Survey, coöperating with the U. S. Geological Survey, has made topographic maps. The later maps of this kind are on a scale of 1 to 62,500, with contour intervals of 20 ft., and are suitable for fairly accurate work. The earlier maps, however, are on a scale of 1 to 125,000, with contour intervals of 100 ft., and may not be used for anything more exacting than reconnaissance work. Outside of the areas of the later maps, bench marks are seldom to be found, except along railroads and the navigable streams. The difficulty of carrying spirit-level lines makes it necessary to use aneroid elevations or those based on assumed datum planes.

Physical and Social Conditions Retard Field Work

Tracts of land are generally of irregular shape and are located by meets and bounds. Their lines follow creeks, ridges, or escarpments, and corner posts are not infrequently trees that have been removed since the original locations were made. Physical difficulties are not alone to be overcome. In the eastern mountainous part of the state the scattered population often regards strangers with suspicion. Nowhere in the United States have physiographic conditions influenced the lives of a people to a greater degree. In the social conditions existing there novelists may find—as some of them have found—absorbing themes and inspiration. Considering the numerous feuds, the tragedies following holiday revels with "moonshine" and the activity of armed revenue officers in breaking up illicit stills, Daniel Boone's characterization of "dark and bloody" still retains some of its original significance. Good living accommodations are difficult to secure. Parties of field workers provided with proper camping facilities may live comfortably, but the individual who expects to live off of the country must possess a hardihood that cannot be daunted by sleeping in a one-room cabin with an entire family and eating an unvaried diet of fat pork and corn bread.

Drilling is not generally difficult. Very few holes exceed 1000 ft. in depth, and many of the best wells are less than 500 ft. Serious water troubles are seldom encountered, and many wells are drilled in without casing. With proper facilities it is possible to average about 50 ft. per day, and the present cost of drilling is about $2.50 per ft. Standard rigs are sometimes used, but much of the drilling is done with portable drilling machines. During the summer of 1917, 200 drills were reported to be at work, and greater development would have been shown had it been possible to obtain supplies.

Poor Roads Retard Movement of Drilling Equipment and Casing

Water and fuel are easily obtainable in most places. The greatest difficulty encountered is in getting the equipment and casing to the ground. Except in the Blue Grass country and in regions contiguous to the larger centers of population, Kentucky roads are very poor. In the eastern part of the state they are generally unimproved creek bottoms, while in other places they may be graded, but often without surfacing material, and transportation is a real problem. Equipment is often moved over the hills with block and tackle.

Oil Production Exceeds Three Million Barrels in Five Years

According to figures published by the U. S. Geological Survey, the production of oil in Kentucky during five years was as follows: 1912, 484,368 bbl.; 1913, 524,568 bbl.; 1914, 502,441 bbl.; 1915, 434,274 bbl.; 1916 (estimated), 1,200,000 bbl. The 200% increase in production in 1916 was due to rapid development and extension of the Irvine pool and the Allen County pool. The above figures represent oil actually sold. Many wells have been drilled in places remote from pipe lines or railroads and have been plugged because the production cannot be marketed.

Oil Refined at Eastern Plants

The Cumberland pipe line running eastward from Cumberland County, and its branches, carries most of the oil from the southern and eastern parts of the state. The branch line running out of the Irvine field carried oil to its full capacity and under the highest pressure permissible during 1917. The greater part of the oil goes to eastern refineries. There are, however, two small refineries in course of construction, one near Irvine, in Estill County, and the other at Rodemer, in Allen County. Others are to be located at Scottsville, Bowling Green, and Louisville, according to persistent rumors. Somerset grade of oil is selling at $2.55 at present and Ragland grade at $1.20 per barrel.

Future Production Dependent on Small Producer

Kentucky ranks about eleventh in the list of oil-producing states. It is doubtful if it will ever advance that rating, although it is conceivable that the present production may be doubled or tripled. There is nothing to justify hopes of finding pools of the gusher type, although, in the course of future development, some wells may produce 500 or 1000 bbl. per day; but the majority will produce less than 50 bbl. However, steady five-barrel pumpers are not to be despised where drilling costs are low, if there are enough of them, and these are of the type to be expected in Kentucky. These statements are not intended to minimize the importance of the Kentucky fields, but rather to emphasize the fact that future development will be in the hands of small producers.

It may be conservatively stated that 90% of the holes drilled prior to 1915 were "wildcats" in the sense of not being justified by geologic evidence. This condition has improved, but there is still a greater number of unproductive holes drilled every year than there ought to be. So far as I have been able to learn, no wells have been brought in "off structure," and the anticlinal theory is fully supported by facts. It should be apparent, from the foregoing discussion, that many of the factors that control the accumulation of oil in commercial pools are extremely variable in Kentucky. Operators will therefore save considerable unnecessary expense by availing themselves of every obtainable item of geologic evidence before taking up leases or locating sites for drilling.

Flotation at Cobalt, Ontario*

Flotation has passed through the experimental stage in the Cobalt camp, and is now firmly established as the most economical method of saving the silver values in the Cobalt ores formerly not recovered by gravity methods of concentration. It cannot be said that flotation practice has replaced the standard gravity concentration to the same extent as in the copper-mining camps of the West, but it is particularly adaptable to the recovery of the more friable silver minerals and fine leaf silver, which escape recovery by ordinary gravity concentrating machinery. At present the following mills use the Callow pneumatic system of flotation in the Cobalt district: Buffalo Mines, Ltd.; McKinley-Darragh-Savage Mines; Nipissing Mines; Coniagas; Dominion Reduction Co.; Northern Customs Concentrators, and the National Mines. Of these the Coniagas and Dominion Reduction have each added 200 tons daily capacity to their initial installation, and in the new tailings mill of the McKinley, the flotation unit will be greatly increased. In the district as a whole, Callow pneumatic installations have a total daily capacity of 2350 tons.

FLOTATION RESULTS AT McKINLEY-DARRAGH-SAVAGE MINES COBALT, ONT., DECEMBER, 1916, AND JANUARY, 1917

Month	Quarter	Heads	Tails	Concentrates	Per Cent. Extraction
December, 1916	1st	5.36	1.68	220	69.19
December, 1916	2nd	6.56	1.01	206	85.02
December, 1916	3rd	7.10	1.03	289	85.80
December, 1916	4th	7.55	1.15	443	84.98
January, 1917	1st	6.65	1.17	568	82.58
January, 1917	2nd	7.30	1.30	436	83.80
January, 1917	3rd	5.70	1.00	364	82.68
January, 1917	4th	4.70	0.90	335	82.95

Due to the excessive marketing charges, it is economical to produce high-grade concentrates, even at the sacrifice of recovery. With the exception of Buffalo mines and Dominion Reduction, the companies producing flotation concentrates depend on United States smelteries for the disposal of their products, and the schedules are high.

It has been found that the economic limit of grinding for flotation appears to be reached when not more than 1 or 2% is retained on a 100-mesh screen. Practically all the plants use an oil mixture consisting of pine oil, coal-tar creosote and coal tar. A mixture of 15% pine oil, 75% coal-tar creosote, and 10% coal tar is efficient.

Recoveries by flotation are found to vary over a wide range at the different plants, depending on the product going to flotation, the grade of concentrates required, and the experience of the operators. This last factor will be negligible in time, as there will soon be many efficient operators in the district.

The table presented gives the value of the heads, tailings and concentrates and the per cent. recovery at the McKinley-Darragh-Savage Mines, from mine and mill slime, for the months of December, 1916, and January, 1917.

The excessive charge[1], equivalent to 20% of the market value of the product, led to extensive research work by the metallurgists of the district to devise a satisfactory method for the local treatment of such concentrates. The paper presented by Robert E. Dye, of Buffalo Mines, Ltd., at the 1917 annual meeting of the Canadian Mining Institute, describes in detail the work done over a long period at the Buffalo mill and the results obtained. These may be summed up as follows: A chloridizing roast, followed by leaching, either with cyanide or an acid-brine solution, has given the best results to date. By this method a 95 to 98% extraction of the silver values is being obtained.

The Holt-Dern furnace has been found to offer several advantages over the ordinary reverberatory type. This furnace is simple in construction and cheap in operation. The standard roasting furnace consists of a rectangular roasting chamber 7 ft. x 9 ft. x 4½ ft. deep, with a hoppered bin under the grates for the discharged product. The fuel for the roast is furnished by the sulphur in the charge, and the roast is maintained by an air blast of 2000 cu.ft. per minute and 12 to 16 oz. pressure per sq. in. Products to be roasted, with the requisite amount of salt, additional sulphur (if necessary, in the form of pyritic ore), are all intermittently mixed, and then moistened to the proper degree. Assuming the furnace to be in running order, the cycle of operations is about as follows: With the roasting zone within about two feet below the top of the furnace chamber, the mixed charge, equivalent to about 20 in. of depth, is dropped into the furnace and levelled off. The blast is turned on, and the roasting zone again moves up through the charge at the rate of about one foot an hour. When the roasting zone has again reached the top of the charge, the blast is turned off and the grates are shaken till the charge is again lowered about 20 in. This completes the cycle. The roasted product is withdrawn from the hopper bin underneath the grates and transported to the leaching department. The use of an acid-brine solution to dissolve out the economic metals, as practiced at the Tintic Milling Co., Silver City, Utah, would seem to offer some economy over the use of an acid leach, followed by cyanidation, but this has not yet been demonstrated on a commercial scale on Cobalt concentrates.

Buffalo Mines Co. has at present (July, 1917), one standard Holt-Dern (7 x 9 ft.) ready for operation, and the leaching plant is being erected. The Dominion Reduction Co. installed two Holt-Dern furnaces, each 4½ ft. x 4½ ft., inside measurements. These two furnaces will have about two-thirds the roasting capacity of the Buffalo installation, and the plant will be extended to treat custom concentrates. The three Holt-Dern furnaces mentioned have a daily capacity of 21 tons of flotation concentrates.

A Liberty Bond gives you a look into the future, but defeat in the war will keep you tied to an unfortunate past.

*Excerpted from the 26th Annual Report of the Ontario Bureau of Mines, 1917.

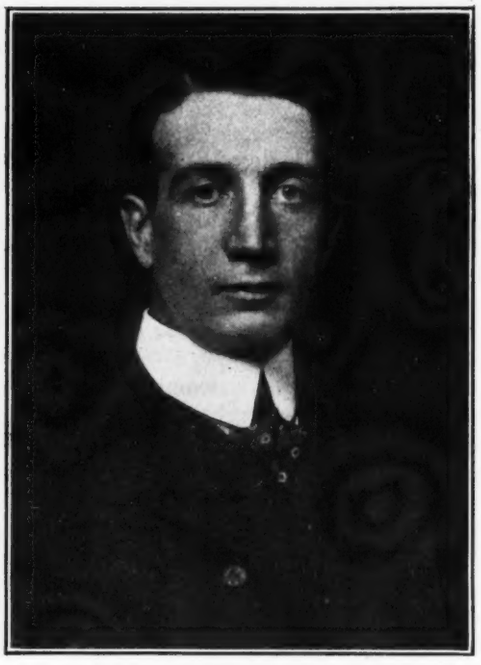
[1]The total marketing cost for 1 ton of 300-oz. concentrates was calculated to be (approximately) $39.82 at a time when silver was 80c. per oz.

Well-Known Mining Engineers in the Service

MAJ. S. R. ELLIOTT

MAJ. J. C. GREENWAY

CAPT. W. H. LANDERS



CAPT. R. H. CHANNING, JR.

Use of the Cement Gun in the Coeur d'Alene Mining District

Extensive application is being found for the cement gun in mining and milling operations, and in the Coeur d'Alene district the results obtained by the Hercules Mining Co. at the Burke and Wallace mines have been excellent. In each case where work was done with the cement gun, the time required for completion was less than what it would have been had hand methods been employed, and the expense has been less.

THE Hercules Mining Co., at both the Burke and Wallace mines, has made use of the cement gun in recent improvements, with a saving of time and money. The canyon at Burke is very narrow, and in order to provide ample tailing and waste dumps, the management has found it necessary to build high cribbing to impound the waste. The machine shops, sorting plants and other structures have been built on top of the spoil banks, so that if the cribbing should be burned these buildings would be destroyed and there would be a greater loss in the closing of the canyon. It was therefore determined to fireproof the cribbing by covering it with mortar. On the face of the cribbing small furring blocks were first placed to insure that the wire mesh would clear the face of the timbers, and to these blocks the wire mesh was attached, care being taken to cut an opening at the end of each tie log, in order to secure comparatively true planes. To the wires, projecting at these logs, were fastened small cap pieces of reinforcement. All of the mesh was firmly stapled to the logs and furring blocks. Between the logs, the voids in the back fill were of considerable extent, but it was deemed advisable to attempt to fill them with the cement gun, using a mixture of four parts sand to one part cement, and thus obtain practically a retaining wall with the face timbers fully incased. The face was finished off with about ¾ in. of mortar. Fig. 1 shows the crib before the placing of the mortar after the furring blocks have been placed, and Fig. 2 shows the crib after completion.

At Burke the gun was next used in the construction of a reservoir. In a gap about 250 ft. above the level of the portal of the lower tunnel an excavation about 26 ft. in diameter was made in the rock. Across the outlet end a concrete wall 26 ft. high was built, after which the upstream face of this wall, as well as the entire surface of the bowl, was covered with about 3 in. of gunite. The mixture used was one of cement to four of sand, with an addition of about 10% hydrated lime. No attempt was made to obtain a smooth surface, the rock contour being followed. The reservoir, holding about 190,000 gal., has never shown any leak except a small one where the outlet pipe passed through the wall, and this was probably due to the fact that no flange was shot around the end of the pipe. The roof of a rope house was next covered. This roof was 22 ft. wide and 102 ft. long, and was slightly arched. Sheeting was nailed to rafters having 18 in. centers and light tar paper placed on top. The ¾-in. furring strips were tacked on and on these 1-in. mesh chicken netting. A one to four mixture was shot on to a depth of 1¼ in. The work was completed in two days. Heavy rains and 14 in. of snow have developed no leaks.

The walls and the roof of a three-story hall and clubhouse was next treated. This building is 70 x 88 ft. and

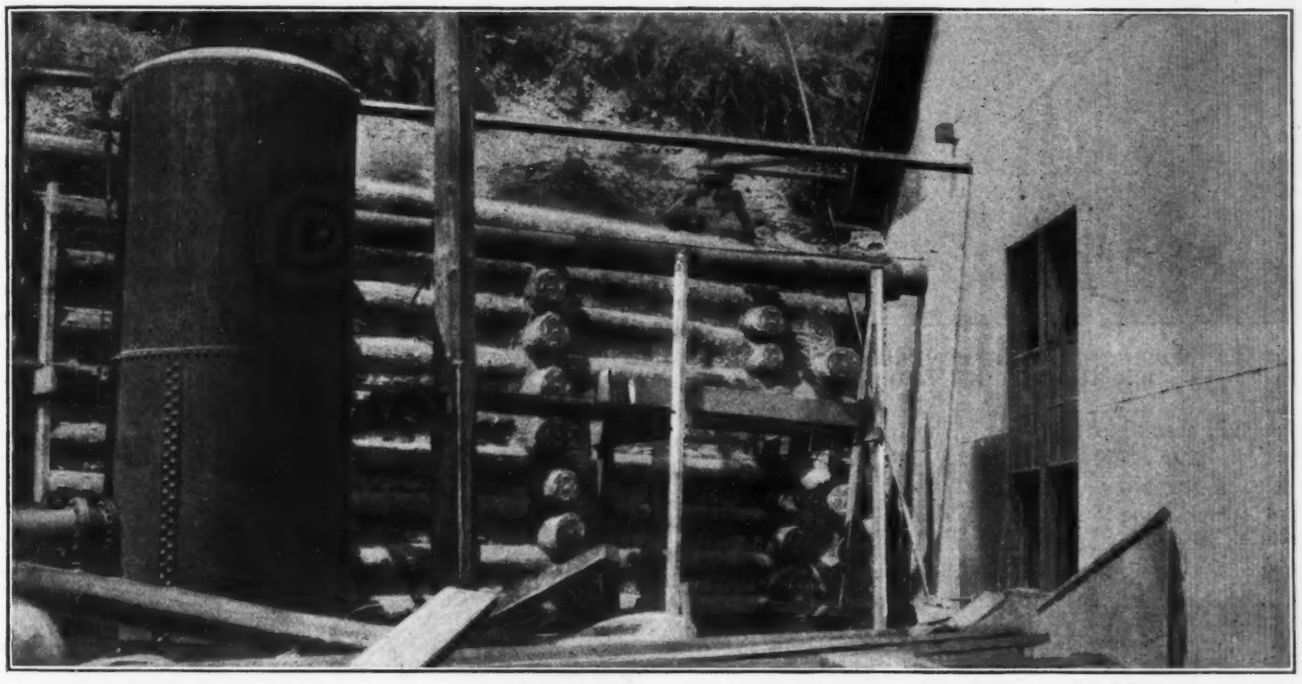


FIG. 1. SHOWING CRIBBING AT BURKE MINE, BURKE, IDAHO, PREPARED FOR THE USE OF THE CEMENT GUN

55 ft. high. The studding consisted of 2 x 6 in. planks spaced 16 in. centers. On the outer face of these was tacked building paper and on top of this a light tar paper. Three-eighths inch furring strips were then nailed on, and on these expanded metal lath. The walls, the coping and the tower (amounting in all to about 20,000 sq.ft.), were shot to a thickness of 1¼ in., and the concrete basement walls given a stucco coat, in eleven days. No hand finishing whatever was done on the walls, the entire slab being shot on at one application. The finished surface approximates a true plane. These walls have been completed three months, and only

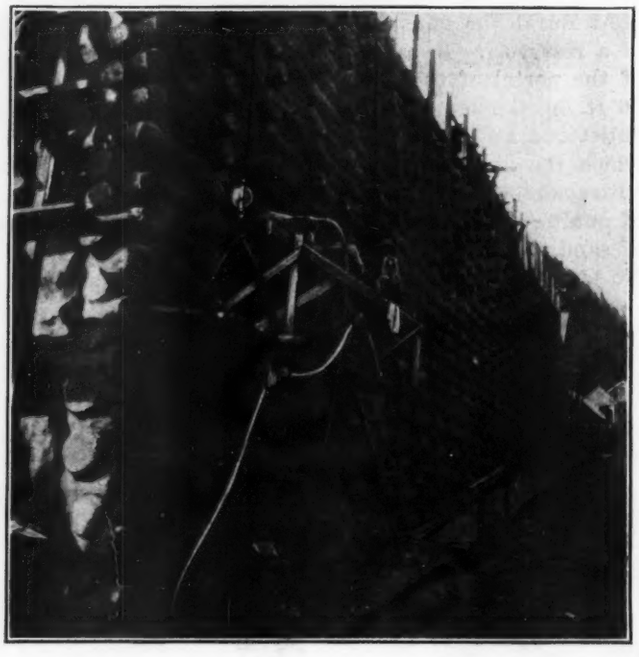


FIG. 2. SHOWING CRIBBING COVERED WITH CEMENT AND CEMENT GUN IN ACTION

one small crack has occurred. The roof of the building, an area of over 6000 sq.ft., was shot to a thickness of 1¼ in. in three days. The roof was concave. The sections which slope to a central drainage point were arched 5 in. to take care of expansion. The construction consists of 2 x 8-in. planks spaced 16-in. centers and covered with shiplap, on top of which tar paper was placed. Three-eighths-inch furring strips were then nailed on and 1-in. chicken netting stretched tight and fastened to them. One and one-quarter inches of gunite was shot on, a one-to-four mixture being used with an addition of 10% hydrated lime. After this had set, a coat of Flotine paint was applied. Melting snow has shown one small leak around a vent pipe, but this was easily stopped. This leak was probably caused by a heavy rain falling the night after the roof had been shot. The wooden lath having been purchased before the gun was decided on, the inside of the building was hand plastered. Two of the best hand-plasterers obtainable, with a crew of one mud man and three helpers, or a total of six men, placing plaster ⅜ in. thick, did not cover as much as was done on the outside walls by a crew of five men with the cement gun, placing material 1¼ in. thick.

Fig. 3 is a view of the front of a large ore bin. Studding was placed between the posts, and on this old boards were nailed with 3-in. furring strips, to which was nailed diamond-mesh expanded metal lath. Gunite, 1¼ in. thick, was shot on at one application, no hand work being done. This surface is 77 x 36 ft., and was completed in 1½ days at considerably less cost than galvanized iron, and presented a neater and superior wall. The same company completed at the Hercules Mine, at Wallace, last fall, a tank 60 ft. in diameter for the Franz thickener. The bottom of this tank was lightly concave in shape, and was built of hand-placed concrete. A tunnel, through which the thickened product is drawn off, extends underneath the bottom from the center of the tank to a point outside. On the radius of the walls of the tank ⅝ in. square twisted rods spaced about 4 ft. on centers were placed upright in the foundation concrete, extending about 8 ft. above the foundation. The upper three inches of these rods were bent at right angles. Three-quarter inch square twisted rods, bent on a roller to a radius of 30 ft., were then wired to the vertical rods, the spacing ranging from 3 in. at the bottom to 10 in. at the top. The walls of the tank had to be strong enough to bear the weight and to withstand the vibration of the mechanism, which consisted of a 16-in. worm rotating at 12 r.p.m., the actuating mechanism being a 5 hp. motor and the necessary gears mounted on a truck which runs on rails on top of the walls. It was therefore deemed advisable to make the walls 6 in. thick.

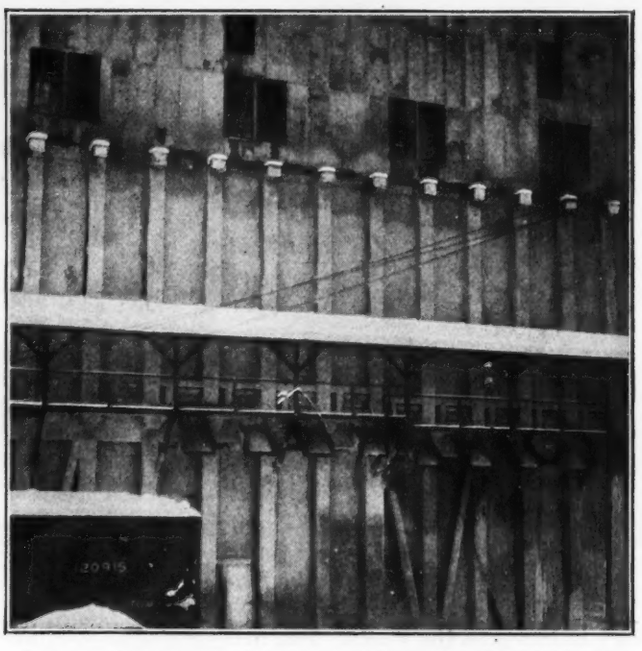


FIG. 3. SHOWING ORE BINS COVERED WITH GUNITE

On top of the rods two layers of reinforcing mesh were placed. Templates, cut from planks to a radius of 30 ft., were attached to the reinforcing 10 in. below the top, and held in place by brackets made of 1½ x ¼-in. strap iron. The brackets were fastened to the boards with stove bolts and were wired to the rods. The lower end of the brackets and the outer edge of the new boards were afterward imbedded in the wall, and to the inner edge the wooden overflow lip was nailed. In shooting the walls of this tank, a canvas form was used. The canvas was first stretched tightly over the outside of the reinforcement, and wired in place, after which it

was thoroughly wet to further tighten it. The gunite, consisting of one-to-three mortar with 10% hydrated lime, was then shot from the inside to a thickness of about 1½ in. After this had set, the canvas was removed and the wall completed by shooting layers from both sides, thereby producing a wall 6 in. thick, with reinforcement in the center. After the sidewalls were completed a layer of triangle-mesh reinforcement was placed on the bottom, and a coat of gunite shot over it, neatly finishing the work at the walls. Water was turned into the tank within two weeks after completion; it has been kept full ever since, and as yet no sign of a leak has developed.

J. T. Torkleson, construction superintendent of the Hecla Mining Co., where the cement gun was also used, stated that the work cost about two-thirds as much as hand plaster and was superior to the latter product. A comparison was made between hand plasterers covering the poured walls and the cement gun on the same work. A wall 105 x 17 ft. was covered ¾ in. thick by hand and cost $75. The same amount applied with the cement gun cost $25, or 0.042c. per sq.ft. by hand against .014c. per sq.ft. by the gun.

Procedure for Obtaining Steel in Great Britain

"The demand for steel in Great Britain is far in excess of the possible supply," says *Iron and Coal Trades Review*, and in order, therefore, to ensure that available supplies shall, as far as possible, be forthcoming for the most urgent work, a system of control has been instituted in conjunction with the Ministry of Munitions.

"The country has been divided into six areas, each of which has been placed in charge of a steel superintendent, who represents the Admiralty and the Ministry of Munitions. One of his chief functions is to advise and assist firms situated in his area in obtaining supplies of steel for authorized purposes, and it is therefore incumbent on all firms requiring supplies to consult with their steel superintendent and follow his directions. The six areas are known as the Scottish area, the North-East Coast area, the Sheffield area, the Manchester area, the Birmingham area, and the South Wales area.

"The rolling program at the principal works of the areas are arranged by the steel superintendent in consultation with expert area committees, composed of representatives of the principal mills, and it follows that the steel superintendent, who is in constant communication with his colleagues in the other areas, is in a position to give authoritative information as to the prospects of obtaining material. To facilitate regular and frequent rollings of sections, thus avoiding serious delays, a list of standardized sections has been drawn up and published.

"The needs of the various services and the country generally have been carefully estimated, and the available supplies have been allocated pro rata thereto. In order to ensure that the supplies available do, in fact, go to the allotted destination, statistical returns are regularly obtained from all the manufacturers, which give particulars of all their deliveries to their various customers. In order to enable these returns to be utilized, the system of what is known as 'prefix lettering' for orders has been instituted. These prefix letters indicate the service for which the steel ordered thereunder is to be used, and it has been laid down that no order may be entered or executed unless it bears its appropriate prefix lettering, followed by the Admiralty or Ministry of Munitions priority or permit reference. All material destined for Admiralty purposes, including every species of floating craft, is dealt with under Admiralty prefix lettering and contract or permit number, and all the remaining services are dealt with under Ministry of Munitions prefix lettering and contract or permit numbers or references."

Swedish Iron-Ore Trade

"Since the early days of the war little information has been available in this country regarding the course of Swedish trade in iron and steel with Germany, particularly as regards iron ore," says *Iron and Coal Trades Review* (British). "This is of great interest, because the Westphalian iron trade depends to a large extent upon Swedish ore imports, although, of course, a considerable tonnage is also taken from Lorraine. From Swedish sources we give below, month by month, from January, 1914, to November, 1917, the Swedish exports of iron ore, in units of 1000 metric tons:

EXPORTS OF IRON ORE FROM SWEDEN

	1914 1,000 tons	1915 1,000 tons	1916 1,000 tons	1917 1,000 tons
January	303	214	223	312
February	294	225	291	237
March	337	272	258	253
April	393	319	247	259
May	525	401	272	329
June	671	595	297	779
July	864	892	484	769
August	211	1,311	767	574
September	252	872	814	718
October	336	689	789	711
November	263	277	709	486
December	227	225	389	...
Totals	4,737	5,993	5,540	...

"The figures for December are not yet available, but the exports for the 11 months of the year aggregate 5,427,000 metric tons. It follows that the exports in 1917 will exceed those of 1916 by about 250,000 tons.

"Some Swedish ore comes to this country, and a good deal is shipped via Narvik, in Norway. Details of the imports of ore to this country are now no longer published, but, as regards 1917, the British trade is to some extent gaged by the 1916 position, and we give below the imports from Norway and Sweden into this country, taken from the Board of Trade returns, together with the Swedish exports, all reduced to British tons:

EXPORTS OF IRON ORE FROM SWEDEN AND NORWAY

	1914 Tons	1915 Tons	1916 Tons
From Sweden to Great Britain	189,949	46,667	432,808
From Norway to Great Britain	429,930	669,088	598,455
Swedish exports to all countries	4,710,400	5,897,000	5,451,000

"While Norway is a considerable exporter of iron ore, the figures point to the fact that Germany has relied to an increasing extent since the beginning of the war upon Swedish exports."

German Zinc Union has agreed to prolong the present agreement till Sept. 30, says *Chem. Tr. Journ.* At present no change will be made in quotations; the demand continues very active, and it is fully anticipated that the use of zinc as a substitute in various industries for copper and other metals, which have become very scarce during the war, will continue when hostilities cease.

Views from Gold Coast Colony, West Africa

OPENING UP A COUNTRY OF DENSE UNDERGROWTH

THE PRESTEA BLOCK-A MILL IS THE LARGEST IN THE TARKWA AND PRESTEA GOLD FIELDS

TYPICAL GROUP OF GOLD COAST NATIVES FROM FANTEE VILLAGE

BATTERY "BOYS AND MEMBERS OF THE STAFF AT THE PRESTEA BLOCK-A MILL

Determining Flow Sheets in New Mills

By A. SCHWARZ*

The importance of determining, before a mill is built, the method of concentration that will give the best results in dollars and cents is emphasized. Tests should be on as large a scale as possible.

OF LATE years it has become customary to make milling tests before erecting mills, and the varying characteristics of ores make this work an important factor in metallurgical operations. Failures have been caused by constructing mills without properly determining the various steps in crushing and extraction by different types of machines to ascertain the most suitable method. Many factors are to be considered. Coarse crushing is largely a matter of crusher efficiency, and can be decided upon usually from available data. The efficiency of rolls which are often employed for intermediate crushing is much influenced by the type and mesh of the screen used between the crusher and the rolls. Excessive fines allowed to pass through the rolls will cause a low efficiency of the latter. The reduction of material in too great steps also lowers the efficiency and increases the wear.

Jigging is sometimes carried too far. It naturally tends to produce fine slimes on sulphide ores, on account of the wear on the mineral cubes. More slimes are thus produced than are usually suspected. Mineral cubes of a given weight exposed to jig action for a number of hours show a remarkable reduction in weight. Upon filtering the slimes from the circuit water, it will be found that they pass through a 300-mesh screen with ease. Table treatment will not recover such fine material, and even if it is saved by other means, subsequent roasting and smelting will show increased losses. The losses from excessive jigging are marked in the treatment of oxide and carbonate ores.

Operating Cost Must Be Compared with Results

Determination of the necessary extent of classifying, settling capacity, re-grinding, table and flotation treatment, etc., is of the highest importance. The coarser the mineral can be extracted, the cheaper and more complete will be the recovery. Cost of operation, as compared with net results in dollars and cents, is the all-important thing, and while a high extraction may be desirable, there are limitations which must be seriously considered. Flotation concentrates, for instance, are not a desirable product for smelteries and are heavily penalized. I had the experience that on zinc ores, for instance, as much as $20 to $30 less per ton was paid for fine concentrates than for coarse.

The grade of concentrates made also has an important bearing on the extraction. I have known cases where a high grade of concentrates was unnecessarily made, decreasing the extraction 15%. These are mathematical problems which should be taken care of by men who make a specialty of that particular line of work. Unexpected results can sometimes be obtained in this way. Thus, in selling their product, several mining companies obtain for concentrates up to a certain grade $1.25 per unit, and above that grade $1 per unit, so that they are actually penalized for making a higher-grade product, which in turn will reduce their extraction. Many hundred tons of this material, running one or two points above the high base, is sold weekly, though it would increase the extraction considerably to stay one or two points below the high base.

Ore for Test Must Be Prepared as in Actual Operation

Ore testing is conducted in a large majority of cases on a small scale, where any error multiplies so many times that the reliability of the tests is much to be doubted. Furthermore, methods of preparing the ore are often employed which do not conform with those used in actual operation. For example, many flotation tests are conducted on ore ground on a bucking board or in a disk grinder. The physical condition of the ore is therefore far from what it would be if rolls or a tube mill were used. Besides, metallic iron is introduced in excessive quantities, influencing the flotation process to a varying degree. Crushing should be done with the same type of machine as will be used in actual milling operation.

In a recent investigation of a lime gangue zinc ore, I obtained good flotation results on the first test. The second test gave only a 20% extraction. I found that the ore in the second test had been prepared by grinding on the bucking board, while in the first case it had been ground in a porcelain-jar tube mill. I made a magnetic separation of the ore ground on the bucking board, and immediately obtained an 85% extraction. I then made a comparative test on ore ground in a steel-lined tube mill with chrome-steel balls and also a test on ore prepared in a porcelain laboratory tube mill with flint balls. The results were practically the same, showing that a small amount of iron introduced in the steel-lined ball mill did not effect the extraction, but that the excessive amount of iron carried in from the bucking board completely upset the calculations. There are, however, methods of treatment by flotation in which metallic iron is purposely introduced. It then becomes a question of how much metallic iron is naturally available from the crushing machinery or whether prohibitive quantities, such as could not be used in practice, will be required.

Scale of Test Must Be Large as Possible

Again referring to the size of the testing machine to be used, I find it beneficial to employ a fairly large machine for final testing. The quantities of reagents, for instance, to be used in flotation are hard to determine with small machines, and the theoretical recovery obtained from small tests on the regular laboratory-size machine is also to be questioned. While it has happened that laboratory tests have often been bettered in practice, I have personal knowledge of a number of cases where the laboratory test was never equalled. The process, therefore, had to be worked out in actual

*Consulting engineer, Joplin, Mo.

milling, which costs a great deal of money. I have found it advantageous for this reason to use, in ore testing, a number of flotation machines that are capable of handling several hundred pounds of feed.

I am using a six-foot thickener four feet deep and several different types of flotation machines in conducting tests. It is apparent that on certain kinds of ore a series treatment with different types of machines often gives better results than a series treatment with the same type. I believe it is sometimes preferable to use a combination of mechanical and aëration machines; at other times either one or the other type of machine alone. During the last 20 years, I have installed a number of ore-testing plants and have found that a continuous operation, whereby the product is mechanically handled from one machine to the other, is not as desirable as the installation of every machine by itself, because in most cases it is necessary to weigh, screen and assay the product of each machine.

Moreover the varying ratio of feed and the varying quantities of products obtained in each part of the operation make it difficult to obtain accurate results.

Arrangement at Ore-Testing Plant

In one testing plant, crushers, rolls, tube mills, jigs, tables and flotation units are so installed that every machine has a receptacle large enough to hold several hundred pounds of product at a charge. Every receptacle, however, is connected to a thickener to make possible a thorough collection of slimes from the entire operation. The product is then taken from every machine, weighed, screened, assayed and hand-fed to the next machine. The flotation machines and the thickener are arranged to work in closed circuit, it being, of course, impossible to handle the slimes without proper settling. The thickener is operated intermittently, causing a certain accumulation of slimes from the various milling machines. These are allowed to settle and clear and are then decanted to a degree of predetermined dilution, which factor is thereafter carried consistently through the test. Thus different degrees of dilution can be tried, the results determined and their relative value estimated. The preliminary testing work on flotation is done in laboratory machines, but final results are verified in the larger machines.

In case of mills already built it is, of course, important to check milling results and particularly the work of each individual machine. Much information can be gained by thorough sampling, by screening the products, and by determining whether the mineral present is free or not. The efficiency of screening and classifying devices should be checked. It is often an easy matter, after determining where important losses originate, to remedy the trouble. Tailings dumps in some cases have been successfully retreated, but in others such efforts have failed for various reasons. The cost of rehandling tailings is heavy. Oxidation and sulphating of the mineral usually prove to be greater than is apparent on casual examination, and it is undoubtedly best to strive for as perfect an extraction as possible at the first milling.

Export Taxes on Metals in Mexico have been reduced by the Mexican government. Effective as of Feb. 1, the tax on metals generally is to be 3% of the value of the metal content of the ore exported. Graphite tax, 1.3% of value.

"But the Engineers—"

"Engineer" is a fine-sounding title that suggests almost anything grand and technical in the way of a job. In our Army, says the *New York Tribune*, it means everything from wire-cutters and sappers on the front line to railway engineers and pick and shovel laborers. Perhaps a good many of us, in our ignorance, have thought of these latter as anything but soldiers, as laborers, merely, behind the line, with the sound of guns in the dim distance.

"But the engineers dropped their tools, and, seizing their arms, fought back fiercely." If this has occurred once in dispatches it has occurred a dozen times. The tools are never specified. It is hard to find out just what sort of "engineer" is referred to. They were American railway engineers at Cambrai—the first American soldiers to do any real fighting in the war. They seem to have been railway engineers again on the road to Amiens. At any rate, "engineers" dropped their tools again and fought, fought so well that the Premier of England mentioned them in the House of Commons as part of that immortal army of odds and ends with which Brigadier General Carey stopped the gap.

So our old conception will have to be modified considerably. Engineers may be equipped with the tools of peace. But they can fight with the best of soldiers, whether they belong on the firing line or not. "Only an engineer" promises to become one of the most honorable titles of the war.

Washing Gold on the Yangtse Kiang

The water of the Yangtse River at the end of January was at its lowest level, writes Consul G. C. Hanson from Chungking, China. Opposite Chungking stretches of its gravel bed were high and dry. On these gravel beds could be seen numerous Chinese washing the sands of the river bottom for gold. The Chinese work in pairs, and the apparatus employed by them is simple. It consists of an inclined plane formed by narrow strips of bamboo placed crosswise on two bamboo poles. Over and at the upper end of this inclined plane is suspended a basket of about half a bushel capacity. Sand and gravel are shoveled from the river bed into this. River water is then poured over the contents, which are shaken during the pouring. The water, carrying with it the fine sand that passes through the meshes of the basket, runs down the inclined plane. The fine bamboo crosspieces of the plane are so arranged that minute particles of gold are caught on the upper edges of each bamboo strip. After a great number of baskets full of sand and gravel are treated in this way, the particles of gold are removed from the inclined plane, which is then ready for operation again. One plane worked by two men will yield daily a quantity of gold equal in value to about 20 or 30c. (U. S. currency). One man shovels the sand and gravel into the basket, while the other shakes the basket and pours water over its contents. It can readily be seen that fortunes are not made in securing gold in this primitive fashion.

Remember the Comfort Fund of the 27th Engineers.

United States Steel Corporation

THE important bearing of the iron and steel industry upon national affairs, particularly since the entrance of the United States into the war, is reflected in the report of the United States Steel Corporation for 1917. Owing to the wide range covered by the report, it is impossible to publish it in full, but a brief review is herewith given, with the conviction that it will be of interest, and because of its importance, inasmuch as the United States Steel Corporation may be regarded as the directing factor in the iron and steel industry in the United States.

The general balance sheet, condensed, is as follows:

GENERAL BALANCE SHEET, U. S. STEEL CORPORATION

Year Ended Dec. 31, 1917

Assets	
Property account, less depreciation	$1,521,836,791.66
Advanced mining royalties	20,666,735.38
Mining royalties	35,098,189.08
Deferred charges	1,857,660.61
Investments	4,355,759.02
Sinking fund assets	65,737,672.82
Current assets	799,997,397.48
Total assets	$2,449,550,206.05
Liabilities	
Common stock	$508,302,500.00
Preferred stock	360,281,100.00
Stocks of subsidiary companies not held by U. S. Steel	480,342.50
Bonded debt, U. S. Steel Corporation	422,299,000.00
Bonded debt, subsidiary companies	164,487,347.74
Notes subsidiary companies	35,098,189.08
Mortgages and purchase money	672,730.11
Current liabilities	340,351,583.23
Reserve funds	75,916,609.76
Appropriated surplus	110,000,000.00
Undivided surplus	431,660,803.63
Total liabilities	$2,449,550,206.05

Of the annual assets, materials and products on hand are represented by $223,668,068.29; accounts receivable, $102,416,124.97, and cash on hand, $184,794,610.78. The net income for 1917 amounted to $244,738,908.36, and is shown in condensed form in an accompanying table. From this is deducted $22,120,151.36 in interest and premiums, and an adjustment of $1,600,807.54 brings the balance to $244,219,564.54.

Dividends, Appropriation and Balance

Total dividends paid amounted to $116,714,127, preferred stock receiving 7% and common, 5% regular and 13% extra. These total $25,219,677 for the preferred and $91,494,450 for the common stock. After deducting dividends and an appropriation of $55,000,000 from the balance, an amount of $52,505,437.54 remains as a balance carried forward to undivided surplus.

Domestic and Export Shipments

Total domestic shipments for the year were: Rolled steel and other finished products, 13,196,910 tons; pig iron, ingots, spiegel, ferro and scrap, 534,768 tons; iron ore, coal and coke, 995,590 tons, and sundry materials and byproducts, 139,998 tons. Total tons of all kinds of materials, except cement, 14,871,266, and this item shows a decrease of 0.4% from 1916 shipments. Universal portland cement shipped equalled 10,398,759 bbl. The value of domestic business amounted to $1,026,393,678, an increase of 46% over 1916.

Export shipments amounted to: Rolled steel and other finished products, 2,173,195 tons; pig iron, ingots and scrap, 19,479 tons, and sundry materials and byproducts, 1911 tons. Total tons of all kinds of materials, 2,194,585, which is a decrease of 12.3% from 1916 shipments. The value of export business amounted to $179,488,730, an increase of 19.3% over 1916.

Wages Increase 65 Per Cent. in Two Years

Two general increases in wages were made, on May 1 and Oct. 1, respectively, and these advances, together with those made in 1916, bring the total increase to 65% above the rates previously prevailing at the end of 1915, that is, for unskilled labor. During the year 11,486 employees entered the regular war service of the United States.

Prices Advanced, and Demand Exceeds Supply

Not only was there a material advance in the prices of steel products, caused by the increased cost of labor, raw materials and supplies, but the demand largely exceeded the producing capacity of the manufacturers. Unfilled orders amounted to 9,381,718 tons of rolled-steel products, a decrease of 2,165,568 tons from those in 1916, which was the highest total recorded in the history of the corporation. Conditions prevailing in respect to Government regulation of prices, priority orders on production and the demands for war purposes, directly or indirectly, of a large percentage of the output of the mills, interfered with forward buying by customers.

TOTAL PRODUCTION IN 1916 AND 1917

Products	1916	1917
Iron Ore Mined		
In the Lake Superior Region	Tons	Tons
Mesabi Range	24,928,039	23,806,268
Vermilion Range	1,314,002	1,039,807
Gogebic Range	2,369,460	2,197,554
Menominee Range	996,983	1,120,382
Marquette Range	647,132	491,760
In the Southern Region		
Tennessee Coal, Iron & R. R. Co.'s Mines	3,099,553	3,125,998
Totals	33,355,169	31,781,769
Limestone Quarried	7,023,474	6,494,917
Coal Mined		
For use in the manufacture of coke	26,606,041	24,554,525
For steam, gas and all other purposes	6,162,340	6,942,298
Totals	32,768,381	31,496,823
Coke Manufactured		
In bee-hive ovens	12,479,160	11,177,247
In byproduct ovens	6,422,802	6,284,428
Totals	18,901,962	17,461,675
Blast-Furnace Production		
Pig iron	17,412,049	15,460,638
Spiegel, ferromanganese and silicon	195,588	192,290
Totals	17,607,637	15,652,928
Steel-Ingot Production		
Bessemer ingots	7,273,766	6,405,390
Openhearth ingots	13,636,823	13,879,671
Totals	20,910,589	20,285,061
Rolled and Other Finished Steel Products for Sale		
Steel rails (heavy and light tee and girder)	1,533,681	1,594,196
Blooms, billets, slabs, sheet and tinplate bars	1,881,526	1,692,348
Plates	1,332,262	1,473,625
Heavy structural shapes	1,029,682	1,004,537
Merchant steel, bars, hoops, bands, skelp, etc.	2,715,277	2,650,970
Tubing and pipe	1,338,892	1,234,129
Wire rods	278,197	267,071
Wire and products of wire	2,004,494	1,821,985
Sheets (black and galvanized) and tin plates	1,786,642	1,740,949
Finished structural work	557,953	550,744
Angle splice bars and all other rail joints	277,271	207,846
Spikes, bolts, nuts and rivets	95,096	91,980
Axles	173,530	220,291
Steel car wheels	107,167	110,014
Sundry steel and iron products	349,142	282,226
Totals	15,460,792	14,942,911
Spelter	55,898	67,418
Sulphate of iron	46,263	43,942
Fertilizer	8,618	11,574
	Bbls.	Bbls.
Universal portland cement	10,425,600	10,917,000

Output of properties and plants did not reach the record figures of 1916, notwithstanding additions and extensions completed and placed in operation, which somewhat increased the capacity. This decrease is attributed to inability to secure sufficient employees and to the lack of ample transportation to supply plants with raw materials and supplies. Total production for the year, compared with that of 1916, will be found in an accompanying table.

Expenditures during the year for extensions and construction amounted to $121,322,862 and covered a wide range of improvements and included the increasing of capacity and facilities at plants and properties to assist in meeting the urgent demand for steel and other products for the military and naval requirements of the United States.

Extensions of Plants Cover Large Field

Important among the items of work completed or begun in 1917 were: Carnegie Steel Co. completed an additional 110-in. sheared-plate mill; Indiana Steel Co., a 160-in. sheared-plate mill at its Gary works, and Illinois Steel Co., at its South works, completed a 90-in. sheared-plate mill. Tennessee Coal, Iron and R. R. Co. began construction on a 110-in. sheared-plate mill, which will be completed in 1918. At the Duquesne works of the Carnegie Steel Co. an additional 12-in. bar mill was completed; at the McDonald works of the same company nine additional merchant bar mills are nearing completion.

The National Tube Co., at its Lorain, Ohio, works, completed two additional O. H. furnaces, a new 40-in. blooming mill, and a central electric power and light plant. The Gary works of the Indiana Steel Co. finished four additional blast furnaces and a new 40-in. blooming mill. Two additional merchant bar mills and a new forged-steel wheel plant are nearing completion at this plant. The South Chicago works of the Illinois Steel Co. completed a new duplexing steel plant and an electric O. H. furnace. The American Steel and Wire Co. finished a new rod mill and a new mill for rolling flat wire and strips at the Cuyahoga works. At the Worcester, New Haven and Trenton works additional facilities and equipment are being installed for the manufacture of wire rope.

The American Sheet and Tin Plate Co. finished and placed in operation 20 additional tin plate mills, with all necessary equipment, 10 mills having been installed at its Farrell, Penn., and 10 at its Shenango works.

INCOME 1917—U. S. STEEL CORPORATION

Gross receipts	$1,683,962,552.21
Operating charges	1,334,311,536.42
Balance	$349,651,015.79
Royalties and rentals	16,753,576.55
	$366,404,592.34
Other income	11,794,867.15
	$378,199,459.49
Less adjustments and charges	74,037,987.96
Total earnings	$304,161,471.53
Interest and depreciation	59,422,563.17
Net income for year ended Dec. 31, 1917	$244,738,908.36

Substantial progress during the year was made in the construction of byproduct coke plants at Clairton, Penn.; Lorain, Ohio; Newburgh, Ohio, and Gary, Ind., and of a benzol plant by the Minnesota Steel Co. at Duluth, Minn. These plants will be ready for operation early in 1918, and will have 1168 ovens.

Construction of a modern shipbuilding plant on the Hackensack River, near Newark, N. J., was begun in July, 1917, and it is expected that 10 completed ships will be delivered during the year 1918. The plant will have 10 shipways, together with all necessary shops for completely finishing ships. Land was acquired for a site and construction of a shipbuilding plant which started in November, 1917, on the Chickasaw River near Mobile, Alabama.

Equipment for Manufacture of War Supplies

During the latter part of the year, the construction of a gun-forging plant was started; also the enlargement of the works of the National Tube Co. for the manufacture of torpedo air-flask forgings and the installation of machinery and equipment in the armor-plate department for the production of recuperator forgings for heavy guns.

During the year, outlays totaling $3,334,664 were made at Gary, Ind.; McDonald, Ohio; Farrell, Penn.; Donora, Penn.; Clairton, Penn., and Fairfield, Ala., for the construction of dwellings for employees, and the development of the property on which these houses were erected.

Extensive Coal Lands Purchased

During the year there were purchased 57,723 acres of coking coal, including 48,884 acres of surface, situated in Logan and Mingo Counties, W. Va., and Letcher and Harlan Counties, Ky. This coal is of grade and quality well adapted for mixing the Pocahontas and Illinois coals for use in byproduct-coke operations, and will be used principally at the byproduct-coke plants of the subsidiary companies in Western Ohio, Chicago and Duluth districts. They were acquired in Washington County, Penn., and an additional 2070 acres of steam coal.

Additional Transportation Facilities Added

During the year, additional railroad equipment was purchased or constructed for general transportation service, as follows: 31 locomotives, 4280 steel freight cars, 324 box and dump cars, and 28 road cars of various kinds, costing in all $10,002,070. Three 12,700-ton capacity ore-carrying vessels were purchased and placed in commission during the year. One additional steamer of same type was ordered for delivery in 1918.

The total amount unexpended on authorized appropriations for new plants, extensions and additions and betterments, including iron-ore mine-stripping operations for 1918, equalled approximately $187,000,000. It is estimated that about $110,000,000 of this total will be expended in 1918.

EMPLOYEES AND PAYROLLS

Employees of	1917 Number	1916 Number
Manufacturing properties	198,711	187,289
Coal and coke properties	26,189	25,143
Iron-ore properties	13,198	12,624
Transportation properties	26,210	24,189
Miscellaneous properties	3,750	3,423
Totals	268,058	252,668
Total salaries and wages paid	$347,370,400	$263,385,502
Average Salary or Wage per Employe per Day:		
All employees, exclusive of general administrative and selling force	$4.10	$3.29
Total employees, including general administrative and selling force	$4.16	$3.36

Employees of the corporation were offered the privilege of subscribing for shares of common stock at $92

per share. Subscriptions were received from 43,258 employees, and amounted to 95,437 shares. The same conditions governing subscriptions and the distribution of special compensation that have been offered in past years were made. The United States Steel and Carnegie Pension Fund disbursed $712,506.65 to retired employees, 241 of whom were placed on the list during 1917, the total number on the rolls now being 2933.

Safety, Sanitation and Welfare

Amounts spent for safety work totaled $998,806, an increase of $150,726. Fatal and serious accidents per 100 employees showed a decrease of 14.67%, as compared with 1916, and this is regarded as notable in the light that the increased force in 1917 included many new employees not familiar with safety rules and regulations. Accident relief in the sum of $3,171,994 was disbursed for the benefit of injured employees. Additional sanitary equipment was installed throughout the plant and mines, and included drinking-water systems, sanitary drinking fountains, latrines, wash and locker rooms, including 496 shower baths and 15,763 lockers. Welfare work was systematically continued by the corporation during 1917. Many dwelling houses, combining modern conveniences and provided to workmen at moderate rentals, were built. Garden plots were encouraged, the utilized area provided by the corporation amounting to 2082 acres and comprised 15,705 gardens.

Committee Reports Mineral-Control Bill to House

In reporting the Mineral-Control bill to the House, the Committee on Mines and Mining says:

Your committee cannot too strongly urge the importance of this bill for war purposes, so as to provide these necessities which must be secured to carry out the war activities of the Government. All the evidence before the committee has indicated that such a bill is essential, and especially now is it imperative that it should be enacted into law at the earliest possible date, in view of cutting off of ships from foreign trade and putting them into other absolutely necessary use for the Government. It would be indeed unfortunate in the prosecution of this war if the Government should be suddenly deprived of these supplies of war materials which are absolutely essential, and we ought not to take any chances by depending upon importation for these metals and minerals which can be largely developed in our own country. We should be as near independent of the world as possible in war time, and it is believed that under this bill we can secure the supply of most of these necessaries.

The report, which was written by Dr. Foster, the chairman, contains excerpts from the testimony of the Secretary of the Interior, the Director of the U. S. Geological Survey; Prof. B. F. Leith, of the Shipping Board; Bernard M. Baruch, chairman of the War Industries Board; Dr. Richards, of Lehigh University; Pope Yeatman, head of the non-ferrous division of the War Industries Board; Herbert Hoover, the food administrator; F. W. DeWolf, state geologist of Illinois; and of the Director of the Bureau of Mines.

With regard to the licensing feature provided in Section 5 of the bill the committee's report says:

It is not intended by the committee that the Government would necessarily make a complete licensing regulation, but only use it where it is necessary. In the case of minerals enumerated in this bill, the number of those who might be licensed must necessarily be small, so that there will not be any great expense or difficulty in performing this work. There are now 12 producers of sulphur in the United States and probably less than a hundred of pyrites and not more than two or three hundred of manganese.

The report discusses Section 12 of the bill as follows:

Section 12 gives the President the power to take over and operate any mine, smelter, or plant where it is either idle or is insufficiently developed. It is not intended to use this power save as the last resort, but it would only be available in cases of emergency. Where a mine cannot be operated on account of litigation or there may be a refusal to develop the property, or, because of its inaccessibility, private capital is unable to operate it, such proceeding might be necessary, but the primary purpose of this bill is to stimulate the production of mining by private capital wherever it is possible to do so. This section is also intended to take care of any cases where other methods provided in the bill might fail and where the output of that particular mine might be absolutely necessary. The section provides also for the restoration of such property to its owners as soon as the necessity is over, and also provides for just compensation for any damage or depletion which may occur.

The guaranty clause is referred to as follows:

Section 14 is a very important section in the bill. It grants power to establish a guaranteed price in order to insure reasonable profit to the producer and in that way stimulate production. It fixes the time of such guaranteed prices for two years. This section also provides that duties may be placed upon the import of necessaries sufficient to bring the price of the imported article to the same level as any guaranteed minimum price which may be established. This provision, of course, is understood to be for the protection of the United States Government, so it may not be compelled to buy these necessaries at higher prices that might be fixed for the imported article. After the Government has established the guaranteed minimum price, it would, of course, have to make effective the purchase of such ores and minerals as offered for the period of two years. If the war should suddenly end, there would probably be an increased importation. This section also provides for a reasonable time for the President to close up the business when the war shall end. It is believed it is necessary to guarantee these prices on necessaries in order to stimulate the production. It is also believed that the power to fix prices is necessary in order to effectively secure reasonable prices between the producer and consumer.

Wages Paid in California Oil Fields

In a paper[1] presented at the February meeting of the A. I. M. E., M. L. Requa gave the data condensed in the table that follows. The wages are those that ruled early in 1917.

DAILY AND MONTHLY WAGE RATE IN CALIFORNIA OIL FIELDS IN 1917

Drillers:	Coalinga	Kern	Midway, Maricopa and McKittrick	Coast	South	Lost Hills and Belridge
Rotary	$230.00(a)	.....	$230.00(a)	.....	$6.50	$230.00(a)
Standard	7.00	$6.50 to 7.00	7.00	$5.50	5.50	7.00
Toolies	4.50	4.00 to 4.50	4.50	3.50	3.00	4.50
Firemen	4.00	3.25 to 3.50	4.00	90.00 (a) to 140.00	100.00(a)	4.50
Pumpers	3.50	3.00 to 3.50	3.50	80.00	2.50	3.50
Gang pushers	4.50	4.00 to 4.50	4.50	100.00(a)	100.00(a)	4.50
Well gang men	3.50	3.15 to 3.50	3.50	80.00(a)	2.50	3.50
Laborers and teamsters	3.00	3.00 to 3.25	3.00 to 3.50	80.00(a)	2.50	3.00
Gas engine man	150.00(a)	.....	4.00 to 6.00	105.00(a)	100.00	5.00
Carpenters	5.00	4.00	4.00 to 5.00	.....	90.00	5.00
Mechanics	5.00 to 6.00	.....	5.00 to 6.00	5.00	.....	5.00 to 6.00
Gagers	.....	.....	75 to (a) 90.00	.....	.....	75.00(a)
Rig builders	.....	.....	6.00	5.00	5.00	6.00
Electricians	125.00(a)	.....	125.00 to 180.00(a)	.....	85.00(a)	.....
Blacksmiths	.....	.....	5.00	4.00	4.00	5.00

(a) Monthly wage; others are day's pay.

[1] "Methods of Valuing Oil Lands," A. I. M. E. Bull. No. 134, p. 417.

Correspondence and Discussion

Sidelights on Alaska

The Alaskan mine from which I write is 20 miles from the Copper River railway, and last summer we built a good road to the property. Two Packard auto trucks and a Franklin car were purchased for hauling purposes, but soon after the road was completed heavy snowfalls, attended by winds, drifted the roads so that all the winter hauling had to be done by teams. Incidentally, an air-cooled car is not suited to a cold country; it is an advantage to have a water-cooled car, as one can fill the radiator with boiling water or warm it up at any place where a fire can be built, while with an air-cooled car one must keep it running to prevent freezing once the car is taken out of a warm garage.

The Kennecott mine, which I visited early this year, is an interesting property both in regard to the ore and in the treatment of the tailings from the mill by the ammonia process that Mr. Stannard has developed. This process is simple, consisting of dissolving out the carbonates of copper by leaching with a solution of ammonia. The sulphide minerals are not dissolved, although there seems to be an impression at Kennecott, in regard to the process, that the ammonia treatment does dissolve the sulphides. Things have been quiet at the Kennecott since the strike.

Alaska, I find, is an agreeable place to spend the winter. We had cold weather in December—it was down to 65° below zero at Strelna, although at the mine the lowest has been 40° below. It is usually warmer on the hills than in the valleys, and our logging camp, 2000 ft. lower than the mine, is 10° colder than up here. I walked from Strelna out to the mine —20 miles—with the temperature down to 60° below and enjoyed the experience. We make the 20 miles in eight hours, including the climbing of a pretty steep hill. I lived in a tent all winter until a few days ago, when it caught fire from sparks from the stovepipe and burned in ten minutes, taking all my clothes and a lot of other things along with it—a mighty cheerful experience. I have not had a cold all winter, and, on the whole, I have enjoyed the winter here and have felt sorry for those who had to stay in New York, which has had a severe winter, from all reports that have come up here. Summer in Alaska is h—l. It rains prolifically, is never warm, and mosquitoes are thick and can sting through boiler plate.

X. Y. Z.

Strelna, Alaska, Mar. 9, 1918.

Deposits of Antimony in Nevada

Your editorials "A Minerals and Metals Administration," of Mar. 2, and "Our Deficient Minerals," of Apr. 6, call for an answer. I have personally examined many antimony deposits, both in Nevada and California, and studied many reports upon antimony properties in Oregon, Washington, Alaska, Idaho, Nevada, and California, which justifies the assertion that there is strong evidence of an abundant supply of antimony in America.

In Nevada there are a number of promising prospects near Lovelock and Unionville, from which considerable ore has been shipped. One of these, in Bloody Canyon, has been credited with $300,000 profit from shipments made in the earlier days to England. Near Austin, there are also several properties, one of which produced nearly 2000 tons of 60% antimony ore. Within three miles of the latter there is a property from which 10 cars of good ore were shipped and in which there are orebodies 40 ft. wide, averaging 15% Sb and opened to a depth of 100 ft. There are croppings showing oreshoots 200 ft. wide which will probably average over 5%. Near Battle Mountain, Nevada, there are a number of prospects. One of these has been opened up by means of 200-ft. shafts and cuts for a distance of 2000 ft. All of these openings show up fair ore. The above are only a few of the prospects visited.

Smelteries have been buying foreign ores because they were cheaper than local ores. This condition is due, in part, to the undeveloped condition of American deposits, which, in turn, is due to the lack of encouragement given the miners, who were afraid to develop because they knew there was no hope of competing against cheap Chinese production. The fluctuation of the markets during the early part of the war did not induce the miners to develop, as they were afraid that the price would not stay up for a sufficient length of time to return the invested capital. In fact, the high prices of 1915-16 only induced the miners to extract the easily available ore, without doing development in any mines.

That smelters have not been able to do more than conduct fitful operations is due mainly to the fact that they were afraid of cheap foreign competition. I believe that American production can, in the future, compete with foreign production if encouraged by means of suitable Government protection until such time as mines are developed and plants enlarged sufficiently to lower the cost of operations.

Why not protect a necessary and infant industry until such time as it shall have grown big enough to protect itself?

NEARAI R. LAYNG.

San Francisco, Calif., Apr. 13, 1918.

Chemicals Used in Ore Flotation

We notice in the *Journal* of Dec. 1, 1917, that Parker C. Choate takes exception to a statement of ours that a sodium manganate or permanganate could be made for certain differential flotation work by fusing alkaline sodium compounds, such as the carbonate, with manganese ore, and then leaching out the sodium manganate. We have recently had the opportunity to talk this matter over with Mr. Choate, and find that both parties to the dispute are right, as far as their claims go.

Mr. Choate has been interested in the production of a salable sodium permanganate and wishes to avoid the use of an excess of alkali. Hence he gets low yields of sodium manganate and permanganate, due to hydrolysis. On the other hand, an excess of alkalies over that theoretically necessary for the manganese ore does no particular harm when the product is to be used for differential flotation, and hence we could get most of the manganese into solution. We are informed that caustic soda gives a more satisfactory yield than sodium carbonate. Mr. Choate's discussion is therefore timely, since it allows us to call attention to this point. At the time he wrote his discussion he felt that our proposal was impracticable, but since talking it over with us he has agreed that while the method is of no value for purposes of making a salable manganate, it is all right for the purpose in view.

O. C. RALSTON and L. D. YUNDT.

Niagara Falls, N. Y., Mar. 1, 1918.

Mining-Camp Welfare

Innovations made at a mining camp for the betterment of living conditions are not always received by miners and their families with the complete understanding which has prompted their installation, but I firmly believe that anything that adds to the moral and physical welfare of the employees is always worth while, regardless of the appreciation it may arouse.

Many mining camps have little or no area of level ground, so that often baseball or football is out of the question. Some camps have clubhouses and others have stores where the miners can congregate, but I think that it would be desirable for all camps, of any size, to have a recreation building, with an auditorium sufficiently large to permit the holding of lectures and bi-weekly picture shows. There should be a lounging room provided for reading, writing and the playing of cards and games. Good bathrooms, with hot water, should also be maintained. A joint committee of the men and company officials could supervise the building.

In a camp big enough to be provided with a school, the teacher should be of such calibre as to organize and direct a Boy Scout division and one of a similar order for the girls. Nevada City offers an irrefutable argument for the value of such a movement and has been an educator along the lines of true morality as applied to daily practice, and not brought out merely when the occasion seemed to demand it. I would have a place where the simpler gymnasium apparatus could be supplied for the use of the boys and girls. Horizontal bars, swings, slides, and basket-ball equipment should be possible anywhere.

Another more ideal experiment would be a series of domestic-science lessons for the miners' wives, that could be made practical, so that "the survivial of the fittest" would no longer apply to the victims of this class of experiments. As a rule there is little or no knowledge of food values to be found anywhere in a mining camp. The enforced use of canned goods does not tend to increase strength or good digestion, and in the case of small children may work permanent injury. As a consequence, there is a large and rather unintelligent use of patent medicines and stimulants for both grown-ups and children. A better balancing of the food ration would obviate much of this, while a better knowledge of the medicines would point out their danger.

The teacher of a school in such a community has an excellent opportunity for splendid service along with her regular work, and if she has had training in practical dietetics she can be of great service in the ways already mentioned. If not, a good teacher of this important subject should be secured, so that regular courses of domestic science may be given in the auditorium or in the homes of the miners.

C. R. BROCKUNIER.

Nevada City, Calif., Apr. 7, 1918.

One Mine Manager and the Third Liberty Loan

I cannot let the opportunity go by of thanking you for the issue of the *Journal* of Apr. 6. The pages devoted to the bond sale, and the articles on pp. 621 and 622, are simply fine.

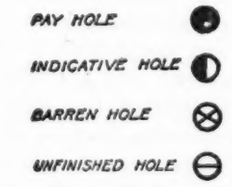
I have arranged a sort of swinging bulletin board in the boarding house, and I am putting on it these advertisements and articles, so that all the men can read them as they get their meals. I shall change them as they appear at different times, and I do believe that they will help me out here in getting the boys to get into this thing to the last dollar. They are the very best things I have seen on the need for the greatest pile of real money the world ever saw.

The Louis d'Or Mining Co.,
by C. E. HART.

Miami, Ariz., Apr. 13, 1918.

Method of Marking Drill Holes Distinctively

I recently observed a drill map of a mining property where the pay holes, indicative holes, blank holes and the abandoned holes were all indicated by the same symbol. In our drilling operations, we always indicate



HELPFUL METHOD OF MAKING BORE HOLES

the results of the hole, marking symbols on the tracing in accordance with the accompanying figure.

It seems to me that a record of this simple method of indicating the results of the drilling and a standardization of same would be of considerable advantage.

JUDD STEWART.

New York, Apr. 15, 1918.

The price of a Liberty Bond is $100. The price of defeat in the war is a lifetime of servitude to German interests.

Company Reports

Butte & Superior Quarterly Report

Operations of Butte and Superior for the last quarter of 1917 are summarized in the following:

	Fourth Quarter 1917
Dry tons of ore milled	126,175
Average zinc contents (per cent.)	15.769
Zinc concentrates produced (tons)	38,700
Average zinc in concentrates (per cent.)	48.777
Total zinc in concentrates (pounds)	37,741,179
Average silver in zinc concentrates (oz. per ton)	18,341
Mill recovery (per cent., zinc recovered in concentrates)	94.844
Mining costs (per ton)	$5.7339
Milling costs (per ton)	$2.4854
Total costs, mining and milling (per ton)	$8.2193

On account of the unusual operating conditions existing during the period, no effort was made to increase the developed ore reserves over and above the tonnage mined and treated during the quarter.

The No. 2 shaft and hoisting equipment were used throughout the period for handling of men, timber and supplies. Sinking on the No. 3 shaft was continued and carried for a further depth of 200 ft., or 20 ft. below the 2000-ft. level. This shaft will be continued to the 2100-ft. level, but it is not expected that there will be any further sinking than this for the present.

The total income for the quarter was $1,749,858; operating costs, taxes and shutdown expenses were $1,185,841, and the profits $564,017, as compared with $95,319 for the third quarter.

Annual Report of Chief Consolidated Mining Co.

The total shipments of ore in 1917 by the Chief Consolidated Mining Co. of Arizona were 59,950 dry tons, classified as follows: Silver-lead ore, 45,231; dry ores (no lead or copper), 13,666; zinc ore, 830; zinc-lead ore, 223 dry tons. Metal contents of the silver, lead and zinc ores were: Gold, 9175 oz.; silver, 1,534,907 oz.; lead, 10,780,540 lb.; zinc, 600,236 lb. Zinc-lead ores produced contained 90,511 lb. zinc and 66,170 lb. lead. Average assay values were as follows: Gold, 0.153 oz.; silver, 25.6 oz.; lead in lead ores, 11.92%; zinc in zinc ores, 36.16%; zinc, 20.29%; lead, 14.84%. The average gross value per ton of all ores was $40.12. Smelting, freight, sampling, etc., cost $14.19, making the average net value per ton $25.93. The net yield from ores shipped was $1,554,714.46, after the payment of smelting, transportation and sampling charges, and the net profit was $427,637.24.

Four dividends were paid in 1917, the first being 5c. and the rest 10c. The total so paid was $309,451.50, against $176,481.05 in 1916. Receipts during the year were $2,057,840.61 and disbursements $1,795,446.95, leaving a balance on hand Jan. 1, 1918, of $262,393.66. Disbursements included $43,681.71 for machinery and equipment and $1,127,316.22 for total mining costs. The company also invested $80,000 in the first Liberty Loan and $79,000 in the second. Among liabilities were included $102,925.09 for depreciation on machinery and equipment and $141,428.27 reserved for taxes. The income from the sale of ore was greater than in 1916, though the tonnage was lower, but the net profit was less, owing to increased costs. Development work during the year comprised 18,438½ ft. of drift, 1626 ft. of raise and 212 ft. of winze.

Annual Report of Jim Butler Tonopah Mining Co.

In the fiscal year ended Sept. 30, 1917, the Jim Butler Tonopah Mining Co. produced 40,297 tons of ore, yielding 11,616.953 oz. gold and 1,017,745.80 oz. of silver, with a gross value of $1,052,600.67. The net Tonopah earnings were $483,675.71, which exceeded those of the previous year by nearly 50%. The total net profit for the year was $512,380.29. The tonnage of mill ore handled was 6192 less than in 1916, but the average grade was higher, which, combined with the higher price of silver, more than compensated for the increased costs and reduction in tonnage. Operating costs per ton were as follows: Ore breaking, $4.11 ($3.01 in 1916); development, $1.06 ($1.79 in 1916); transportation, 71c. (83c. in 1916); treatment charges, $5.33 ($4.79 in 1916); general expense, including taxes, 73c. (38c. in 1916); total operating expenses were $481,271.20, or $11.94 per ton ($10.80 in 1916). For lease ore $20,264.47 was paid (7268 tons at $2.788 per ton).

Development work during the year aggregated 5012 lin.ft. and cost $43,055.64, or $8.591 per ft. ($7.582 in 1916). The average cost per foot of 1377 ft. of drifts was $9.112; of the 2223 ft. of crosscuts, $7.313; of the 1285 ft. of raises, $9.529, and of the 127 ft. of winzes, $15.798. Development cost per ton of ore shipped was $1.152, against $1.915 in 1916, the decrease being due to decreased footage. Ore reserves as of Oct. 1, 1917, consisted of 18,320 tons "positive" ore and 5000 tons of "possible" ore. The company's balance on hand on Sept. 30, 1917, was $485,982.02.

Mount Morgan Gold Mining Co., Ltd.

Ore hoisted by the Mount Morgan Gold Mining Co., Ltd., in the six months' period ended Nov. 25, 1917, was 186,085 tons Mount Morgan ore and 20,286 tons Many Peaks ore. The mill treated 91,135 tons of ore, producing 31,693 tons of concentrates, of which 4178 tons were flotation concentrates, assaying 24.11% Cu and 41.46 dwt. Au. Recovery by flotation of the copper was 53.01% and of the gold 36.96%. Total concentrates from jigging, tabling and flotation averaged 5.61% Cu and 11.54 Au. Mill recovery was 93.65% of the copper and 78.06% of the gold. A total of 150,174 tons was treated at the smeltery, from which was pro-

duced 4114 tons of copper and 48,081 oz. of gold. The jig concentrates were fed directly to the furnaces; table and flotation concentrates were first sintered. A jigging section began operations early in August.

Cost of operations was as follows: Mining Mount Morgan ore, £144,613 (app.); mining and transporting Many Peaks ore, £31,316; concentration, roasting and sintering, £55,007; smelting, £141,786; converting, £23,035; refining and realization charges, £43,369; general expenses, £23,249. The value of the blister copper produced was £615,327.

At the quarries at Marmor and Iron Island, 50,197 tons of limestone flux and 10,646 tons of ironstone were taken out. The company is experimenting with the manufacture of magnesite bricks from magnesite taken from leased ground. During the six months period covered, a surplus was earned of £124,844 1s. 3d., from which dividends aggregating £100,000 were paid. The balance on hand on Nov. 26 was £120,830 7s. 3d.

Annual Report of Caledonia Mining Co.

Production of the Caledonia Mining Co. for the year ended Dec. 31, 1917, was 9,434,900 lb. lead, 1,068,699.84 oz. silver, and 544,801.72 lb. copper. The corresponding figures for 1916 were 10,412,640 lb. lead, 1,297,192.83 oz. silver, and 741,225.17 lb. copper. Dry tons produced in 1917 were 17,982.88, approximating the 1916 production of 17,464 tons. Cost of mining was $2.95 per ton, against $2.61 in 1916; milling, 72c. per ton, against 59c. in 1916, and shipping, 20c., compared with 22c. per ton for the preceding year. The gross value of the bullion was $1,849,254.94, and the net value, $1,364,-266.31, smelter deductions amounting to $484,988.63. Operating cost for the year was $137,110.84, against $147,350.76 in 1916, leaving a profit of $1,227,155.47, compared with a profit in 1916 of $1,154,762.56. Dividends paid for the year were $937,800, bringing the total to date to $2,901,606.05. Net operating profit for the last quarter was $212,322.77. A surplus on Dec. 31 of $730,962.20 was reported.

Report of Coniagas Mines, Ltd.

During the year ended Oct. 31, 1917, the Coniagas Mines, at Cobalt, produced 1,344,267 oz. silver and certain amounts of cobalt, arsenic and nickel (not specified). The average price received for the silver was 78.89c. per oz.; the net cost was 21.36c. per oz., as compared with 15.24c. of the previous year. Overhead expenses, which are included in cost per ounce, amounted to 4.31c. per oz. The dividends paid during the fiscal year amounted to $500,000, making a total dividend disbursement of $8,740,000.

The tonnage of ore milled was 60,929, an average of three tons per stamp per 24 hours. There were 479.8 tons of high-grade concentrates, 1754.5 oz. per ton, and 260.4 tons of low-grade slime concentrates, 225.3 oz. per ton, shipped. Mill-heads averaged 18.56 oz. per ton; sand tailings, 3.03 oz. per ton; slime tailings, 2.46 oz. per ton, and final mill tailings, 2.98 oz. silver per ton. The cyanide plant treated 968.5 tons primary slime, containing 59,573 oz. silver, of which 52,009 oz. were recovered. A total of 2.24 tons precipitate, assaying 23,218 oz. per ton, was shipped. A Callow flotation plant was operated. In the mine the development consisted of 4 ft. shaft-sinking, 1223 ft. drifting, 768 ft. cross-cutting, 329 ft. raising; a total of 2324 ft. From cross-cutting, 2304 tons waste, from drifting 3670 tons of ore and from stoping 48,357 tons of ore were produced. The average force of men for the year was 110.3, distributed as follows:

Mine office and supervision	6.77
Camps and buildings	5.54
Maintenance of buildings	1.18
Camp expense	0.60
Lands and roads	1.43
Mining	63.80
Mining maintenance	3.20
Drills, tools, hardware	1.19
Fuel oil and waste	0.14
Milling	15.00
Milling maintenance	3.96
Cyaniding	1.05
Cyaniding maintenance	0.19
Flotation	2.68
Flotation maintenance	0.16
Installation of machinery	2.32
Loading ore	0.43
Sampling	0.63
Total	110.27

The total reserves amounted to 118,909 tons, with a silver content of 4,487,590 oz. Prospecting ventures for several years, involving a total expenditure of $150,000, have not succeeded in locating another silver property worthy of development. At South Porcupine a prospect, the Ankerite mine, is being developed.

Report of Cape Copper Co., Ltd.

In the year ended Aug. 31, 1917, the Cape Copper Co. earned a net profit of £147,841 17s. 7d., to which must be added the credit balance of £69,077 18s. brought from previous year, making a total of £216,919 15s. 7d. Of this, £13,824 8s. 9d. was set aside for English income tax, £16,894 11s. 2d. for taxes outside of the United Kingdom and £77,400 was paid in dividends.

Production of ore was 91,698 tons from following sources: O'okiep mine, 12,845 tons, averaging 8.85% copper; Nababeep South, 51,591 tons, averaging 3.68% copper; Narrap, 2552 tons of 4.93% copper ore; Rakha Hills mines, 19,909 tons of 3.02% copper ore; Terra Nova, 4801 tons, averaging 2.64% copper and 36.89 sulphur. Reserves reported were as follows: O'okiep not given; Nababeep South, 90,000 tons of 5% copper ore; Rakha Hills, 407,641 tons of 3.71% copper ore. Ore exposed in stopes in Rakha Hills mines is of lower grade than indicated by development work. This has necessitated adjustments in the mill, to which a Minerals Separation unit is being added.

Mining costs, including depreciation, etc., were as follows: O'okiep, £40,096; Nababeep, £32,726; Narrap, £2273; Rakha Hills, £38,316; Terra Nova and other trial mines and cost of inspections, £22,204. In general, production costs increased and returns of copper decreased, but higher prices obtained outweighed these disadvantages.

The Nababeep smeltery treated 68,224 tons, compared with 87,951 tons in the preceding year. The decrease was caused by a prolonged shut-down of one of the furnaces to save fuel, which is obtained with difficulty. A sinter plant was put into operation in July, 1917. Employees in the company's service on Apr. 30, 1917, numbered 191 white and 1017 negro. The company's railway in Cape Colony carried 74,918 tons during the year.

Events and Economics of the War

Reinforced by the French, the British withstood the German onslaughts along the Lys and held all main ridge positions unimpaired; a strategic withdrawal was made east of Ypres, by which Poelcapelle and Langemarck were left to the enemy; a lull in the fighting presages a new and violent effort of the Germans to break through; French troops advanced slightly along the Avre; concentrated gunfire has reduced Rheims to ruins; Seicheprey, on the American front, was taken by the enemy in a minor engagement, but was later recovered by American troops; Italian troops are reported to be in France. British naval forces raided Zeebrugge and Ostend on Apr. 22; the U-boat base at Zeebrugge was damaged and the canal used by submarines was blocked with sunken vessels filled with concrete. Vice Admiral Keyes, commanding, was killed.

April 26 was set by the President as "Liberty" day. Issuance of patents and copyrights to enemies has been stopped, and Americans have been forbidden to apply for patents in enemy countries. The Enemy Alien Act has been extended to apply to women, who are now required to register if enemy aliens. The Sabotage bill, minus the anti-strike clause, has received the President's signature; it provides penalties up to 30 years in prison and $10,000 fine for injuring war materials or interfering with war industry. Senator Chamberlain, of Oregon, proposed an amendment to the Sedition Act, by which all cases of sedition will be tried by court martial; this was strongly opposed by the President. The Silver bill passed the Senate on Apr. 18 and the House on Apr. 22. The House voted down the $2.50 wheat clause in the Agricultural Appropriation bill.

Hoover Discusses Buying Monopoly

"So far the Government has developed no principle of price-fixing as a broad economic policy," said Mr. Hoover, discussing the Food Administration recently before the Pittsburgh Press Clubs. "Dislocations apply first to one great commodity and then to another, and therefore our aspect of the problem is to deal with them as they arise, commodity by commodity. We are dealing with conditions and not with theories.

"Disturbances through shortage in supply, failure of inland or overseas transport, or because of other matters with which we must contend, all lead to hardship on either producer or consumer. Our aim is to review the alternative courses of action and to choose that course which leads to the lesser hardship. We are not exploiting economic reform or economic revolution.

"Every export from the United States is under control. It is controlled so that it may serve the positive military ends of the Government. All of our exports are directed to supporting the Allies, or alternatively, where we deal with neutrals, to get the *quid pro quo* for the sacrifice of our commodities. Thus our food exports are directed toward but a few hands on the other side.

"The European governments have been compelled to undertake, as a consequence of shortage of supplies, the single-handed purchase of their supplies, both for civil and military purposes. There has grown up an enormous consolidation of buying for 120,000,000 European people, a phenomenon never before witnessed in the economic history of the world. Furthermore, we have aggregated in this country something like 2,000,000 men under arms, and we shall expand our forces to 3,000,000 or 5,000,000 before we are finished. The buying for these men is necessarily concentrated in one agency, instead of 5,000,000 agencies, as before, and we thus have a second engine growing up in our midst as a necessity of war conditions.

"In order that these two buying agencies should not get in each other's way, it has been necessary to place them under joint direction. In the final outcome, therefore, we find ourselves in the presence of a gigantic monopoly of buying, just as potent for good or evil as any monopoly in selling, and in many instances either making or influencing prices. Therefore, not through theory, but through actual physical fact, the price made by this gigantic buyer dominates the market."

Americanizing the Foreign Employee

The war message may be conveyed to the foreign-born employee in industrial plants by various means. The immigration committee of the U. S. Chamber of Commerce recommends the following:

Post on bulletin boards, headed "War Information Bulletins," posters printed in English and in the principal foreign languages containing current information on the draft, registration of alien enemies, proclamations or new regulations. Cartoon posters from Governmental departments and clippings from current publications often add to the interest.

Distribute to foreign-born employees handbills containing pro-American propaganda, statements of why America is at war, and particulars about Liberty Bonds and War Savings Stamps. Where there are large numbers of non-English-speaking employees, handbills can be printed in the principal foreign languages.

Insert in pay envelopes civic-lesson leaflets and citizenship messages; of these 140,000 sets in various languages have already been used in plants with good results.

Utilize all national holidays for patriotic celebrations to be conducted by local or plant Americanization committees.

Establish a war information service for immigrant employees where they can come at certain hours and receive information on war measures affecting aliens, in their own language if they do not speak English. Draft boards and Liberty Bond and Red Cross Committees can coöperate.

Have speakers address plant meetings in English and in foreign languages. Resolutions of loyalty may be passed at such meetings, and means may be provided for rendering definite war service. Make every effort to interpret the war to foreign-born employees and to counteract anti-American propaganda.

Coöperate with the headquarters of the local Boy Scouts who have recently been made Government dispatch bearers. They can distribute war literature to the homes of immigrant employees.

The immigration committee will furnish, on request, further details, outlines, and forms to aid in the organization of any phase of the program outlined above.

Anthracite Output Increases, Bituminous Production Drops

The growing demand for anthracite has brought about many business changes in the anthracite industry and created intensive methods to increase the output. The operators are planning improved machinery for the mines and offering prizes to workers to devise better methods than those now in use. Any improvements accomplished will revert directly or indirectly to the benefit of the consuming public.

The operators are constantly asking for new mining ideas from any responsible firm or individual, and have just created an "advanced ideas" body to devise ways and means to overcome the handicap of the loss of 22,000 mine workers since the war and to increase, if possible, the maximum output of 275,000 tons daily.

For the first quarter of the year, total shipments of anthracite amounted to 18,727,242 tons, an increase of 619,304 tons—this in spite of the many difficulties which were encountered. Last month 7,276,777 tons of anthracite was shipped, an amount greater than in any previous month in the history of the industry. During the first year that the United States was in the war, the anthracite industry, despite labor shortage, the severe weather obstacles of last winter, and, at times, serious transportation difficulties, actually increased its shipments 14%, or by nearly 10,000,000 tons, the total shipments reaching 77,752,315 tons.

Washington authorities and business men of the country are now openly concerned over the bituminous situation. For the first quarter of this year, the official figures show that the production of bituminous in the United States was less than 133,000,000 tons, or about 2,000,000 tons less than for the same period last year. The showing is that, for the quarter, the bituminous mines averaged only two thirds of maximum capacity.

Income Tax in England

"By all means let the married man pay less than the bachelor," says the London *Graphic*, "and the man with his quiver full less than the childless man; but all ought to pay something. At present the majority of the weekly wage-earners in the kingdom, who can by their votes make and unmake governments, pay practically nothing in direct taxation, and as a necessary consequence very many of them fail to appreciate the fact that citizenship involves duties as well as rights. Probably the only way of rectifying this serious evil is to levy the income tax week by week out of wages, as the insurance tax is levied."

Schools for Replacement Engineers

A course in oxyacetylene welding and cutting is to be opened at the Military Trade Schools, Washington Barracks, Washington, D. C. It has been carefully worked out and designed to fit men to cope with all military problems involving cutting and welding in the field. It will begin May 1, when 60 men from the First Replacement Regiment of Engineers will take up the study.

There are now in operation at Washington Barracks, schools of photography, lithography, map reproduction, surveying, drafting, internal combustion and gas-engine work, machinery, carpentry, blacksmithing, horseshoeing and auto repairing. These schools are organized for the First Replacement Engineers and are part of a three-months' course. The first month is spent in learning infantry drill, manual of arms and the many details of a soldier's life. The second month is spent at Fort Foote, 10 miles from Washington, in rifle practice, engineer drill, bridge building and general construction. The third month is spent at Washington Barracks in the trade schools.

Further information may be obtained from First Lieut. H. L. Havens, E. O. R. C., publicity officer, First Replacement Regiment of Engineers, Washington Barracks, D. C.

Government Plans Concrete Ships

The U. S. Shipping Board is planning to construct three launching ways for three 3500-ton concrete vessels. These ways will be built in one of the southern yards, probably Wilmington, Del., or New Orleans. At whichever yard selected, an organization for building concrete vessels will be formed and directed by the Emergency Fleet Corporation. This type of vessel is yet in an experimental stage. If found to be successful the board may then go to 7500-ton concrete ships.

Roads Must Pay Fixed Price for Coal

Railroads hereafter will buy their coal at the full market price, and cars will be evenly distributed at all mines, under an arrangement reached by the Railroad and Fuel administrations. The agreement followed President Wilson's intervention on Apr. 17 to settle differences between Fuel Administrator Garfield and John Skelton Williams, director of purchases for the Railroad Administration. All coal for railroads will be bought by Director General McAdoo in coöperation with Fuel Administrator Garfield and Bernard M. Baruch, chairman of the War Industries Board. A car shortage exists at present of more than 20% throughout the whole country and of about 35% in eastern bituminous fields, according to the U. S. Geological Survey.

Portugal Takes Over Mines

A decree of the Portuguese government, dated Mar. 14, reserves to it the sole sale and export of all minerals found in the country that are of value in war industries or are effective as exchange in promoting national necessities, according to Consul General Lourie, at Lisbon. The government, through the Minister of Labor, upon the recommendation of the Department of Mines, will fix the prices at which the minerals affected by the decree will be sold. Wolfram and chromium are included in the provisions of the decree, and consequently all exportation of these minerals is prohibited. All stocks of these minerals that exist at present at the mines or elsewhere were ordered declared to the Department of Mines within five days of the publication of the decree, under penalty that the minerals will be seized and placed at the disposition of the government without indemnity.

Enemy Patents Stopped

President Wilson stopped the issuance of patents and copyrights to enemies on Apr. 16 and revoked the authority given Americans to apply for patents in enemy countries. By executive order the President revoked authority previously vested in the Secretary of the Treasury to issue licenses to enemies to take out of the country papers, pictures, or communications relating to letters patent, copyrights, or registration of trademarks. At the same time the Federal Trade Commission was prohibited from granting licenses to American citizens to prosecute patent applications in enemy countries. The licensing authority revoked was granted by the President on Oct. 12, 1917.

War Board Confers on Tin

Conservation of tin was discussed last week by the War Industries Board with practically all of the users of this metal. The conferences were presided over by George Armsby as the representative of the War Industries Board. A. W. Shaw, representing the Commercial Economy Board, took a prominent part. The subcommittee on pig tin of the American Iron and Steel Institute was represented by John Hughes, chairman, and other members. Manufacturers of solder, babbitt metal, bronze, collapsible tubes, tin-foil and silk dyers were among those consulted.

It was revealed at the conference that a careful survey recently made of the world's tin-producing districts indicates that there is little chance of increasing the output during the next two years. For this reason, conservation of tin must be resorted to in order to supply the enormously increased demand for strictly urgent war work.

Emigration After the War

A Zurich correspondent of the *Evening Post* writes that the Swiss Federal authorities have lately stated that after the war Germany and Austria are likely to make a sort of "export prohibition" against persons of their nationality able to do productive work. For this purpose, the Germans will maintain their passport system introduced during the war. The Swiss authorities give the opinion that "Germany will allow only those of her subjects to leave the country whom she considers as being valuable champions for the necessary regaining of lost foreign markets."

Foreign Clays Surpass Domestic?

Users of high-grade imported clays asserted at a recent conference at the War Industries Board that domestic clays can meet their requirements only to a limited extent. Paper makers maintained that all attempts to use domestic clays for coating have been unsuccessful. Pottery manufacturers stated that when the domestic product exceeded 40% the loss from cracking, in burning, became prohibitive. Representatives of the General Electric Co. declared that only foreign clay could be relied upon for making certain electrical porcelains.

Producers of Southern kaolins contended that their clay is equal to the imported and can be used to the exclusion of foreign material. They cited crucible clay as an example. Before the war, crucible makers, it was said, were certain that foreign clays were essential. When suddenly it became impossible for them to receive further supplies from foreign sources, they experienced no great difficulty in adapting domestic supplies to their purpose. The contentions of the producers, however, are not upheld entirely by technical men from the ceramic station of the U. S. Bureau of Mines and from the Bureau of Standards.

Concentrating German Industry

A leading German manufacturer, writing in the *Norddeutsche Allgemeine Zeitung*, says:

"Out of 1700 spinning and weaving mills only 70 are still running at high pressure, while in the boot and shoe industry, 1400 factories have been amalgamated into 300. In the oil industry, 15 factories, working at high pressure, have been formed out of 720 works previously existing. In the silk industry, the number of spindles has been reduced from 45,000 to 2500."

The French *Merchant Marine Annual* says the total French merchant tonnage at the outbreak of the war was 2,498,286. To Sept. 1, 1917, 699,018 tons had been lost through German submarine warfare, partially made good by 51,319 tons built in France during the war and purchase of 134,978 foreign tonnage. This, with 52,000 lost through marine casualties, leaves a total net loss in French tonnage of 564,802. The total tonnage of French merchant ships had therefore shrunk to 1,983,535 tons on Dec. 1, 1917.

Labor in Great Britain was more fully employed last year than ever before, and wages reached their highest average. Nearly 4,700,000 workers received wage advances totalling $11,000,000 weekly. Time lost in labor disputes amounted to 5,500,000 working days, or about half the nine years' average. Cost of principal food articles, however, which averaged 87% over the July, 1914, price at beginning of 1917, had advanced to 106% by end of the year.

A high-intensity electro-magnetic separator is to be installed at the Seattle station of the U. S. Bureau of Mines, which will facilitate the work on complex ores. Until the new electric furnace is in operation at the station it will be impossible to melt tin scrap there. This will hinder to some extent the efforts being made to discover a profitable way of recovering tin from scrap. Representatives of the Bureau are also making special investigation of pyrites mines in Georgia and of the graphite industry in Alabama.

National War Labor Board is composed of the following men: William H. Taft and Frank P. Walsh, representing the general public; Loyall A. Osborne, L. F. Loree, W. H. Van Dervoort, C. E. Michael and B. L. Worden, representing employers; Frank J. Hayes, William L. Hutcheson, William H. Johnston, Victor A. Olander and T. A. Rickert, representing employees throughout the country. The men were appointed by Secretary of Labor Wilson, in accordance with the recommendations of the War Labor Conference Board made in the board's report dated Mar. 29, 1918. The appointments were confirmed by President Wilson on Apr. 9 by proclamation.

Industrial News from Washington

By Paul Wooton, Special Correspondent

Senate Passes Silver Bill

Without the formality of a rollcall, the Senate passed the Pittman Silver bill on Apr. 18. The only important amendment was to increase the number of silver dollars that are to be melted up from 250,000,000 to 350,000,000. The discussion of the bill brought out an interesting array of facts and opinions. Such opposition as there was to the measure is exemplified by the following extract from the remarks of Senator Thomas, of Colorado:

I am suspicious of any movement in the American Congress which has for its purpose the diminution of our silver supply. I want to know why, and I want to know definitely why, it is going to be necessary to take out of the Treasury of the United States 350,000,000 of silver dollars and melt them up, when there is a good deal of silver in the markets, and will be more silver in the markets if the governments needing it will obey the law of supply and demand and pay for it what it is worth and what it costs to produce it.

This question was answered by Senator Owen, the chairman of the Committee on Banking and Currency, as follows:

This silver is lying unemployed as dead metal in the Treasury of the United States as a basis of the silver certificates which now we intend to replace, as far as currency is concerned, with the Federal reserve bank notes, based upon the security of United States one-year gold Treasury notes.

When the Government fixes a definite price for silver the miners can make their plans accordingly, and, seeing for several years ahead a fixed market at $1 an ounce, it will stimulate the production of silver in this country and replace the idle silver which is now in the Treasury merely in storage.

Senator Smoot, of Utah, was very active in urging the passage of the bill. Some of the points he made were:

The annual production of silver for this year in all the world will not be above 160,000,000 oz. The highest production of silver at any time that I can remember now in any one year was 226,000,000 oz. India prefers silver to gold for her metallic money. She is demanding it today in payment for the balance of trade in her favor. India produces wheat and jute and other articles that the war has greatly increased in value, and thus has greatly increased her usual balance of trade against the principal countries of the world, and now she is demanding a settlement and wants it in silver.

I do not believe that we are being treated by our Allies as we are treating them. The Government has fixed the price of copper at 23½c. a lb.; the producer sells it to all of the Allied countries for that price. We not only sell it to them, but we sell it to the general trade for the price fixed by the Government; and yet Canada, our neighbor to the north of us, a producer of copper, receives as high as 30½c. a lb. on the identical day for her copper purchased by England, a difference of 7c. a lb. in favor of the Canadian producer. The same condition exists as to Mexico. Canada is receiving more for lead than we in this country are receiving.

I do not want the Senate to get the impression that this bill, if passed, will be of any benefit whatever to the silver producers of the West. The silver producers of the West would be perfectly content to allow silver to take its regular course in the commerce of the world.

Senator Thomas sees no reason why the price of silver should be rigidly limited to $1 per oz. He introduced an amendment making $1 the minimum price, but the Senate voted it down. Mr. Thomas expects little increase in silver production. His comments on that phase of the question were:

I do not perceive the possibility of depending upon our mines and miners for any greatly enhanced amount of silver, whether this bill becomes a law or whether it does not. Since the adoption of our forest-reservation policy, since conservation has gone so far as to produce stagnation in mining circles everywhere, there has been no great inducement to the prospector to attempt to further prospect and discover ores. Nowadays, the moment a man opens a new body of ore or discovers a well upon the public domain, official and public opinion in the East brands him as a thief and a scoundrel, and, instead of being rewarded, that which he has is taken away from him by departmental action. This bill will not change that situation, however much we give the miner for his silver. The only way to stimulate the production of that or any other metal on the public domain is to go back to the good old way of dealing with the prospector—to encourage him by rewarding him with what he finds by way of discovery. Then he will again endure the heats of the desert and face every danger confronting his pathway in the search for these valuable necessities of trade and commerce. Until he is stimulated by such hope of reward, the mining industry of the West will lag, if, indeed, it does not disappear. The way, therefore, to stimulate him is to let him alone, let the laws of the country operate without interference, and give him the rewards to which he is entitled by virtue of his hazards, his expense, and his discoveries.

Senator Fall, of New Mexico, is the author of the amendment which provides that the purchase of silver shall be made from the production of American mines, smelteries and reduction works.

In the course of his comment on the bill, Senator Lodge said:

I am very much opposed to price-fixing if we ever can possibly avoid it. I think it was a great mistake to fix to our Allies and to the domestic market the price of copper and lead, to which the Senator from Utah has referred; but silver stands, of course, upon a different ground, because it enters into the currency, not only our currency but the world's currency. The situation simply is that, to prevent a financial convulsion in India, silver must be supplied, and we are the only people who can supply it. I see no other way to supply it except that proposed by the committee in their bill, which I think they have guarded well.

I do not take quite such a dark view of the dollar-an-ounce proposal as does the Senator from Utah. I think the stabilization of the price, the certainty, will be worth what they might get on a sudden fluctuation in addition.

I have been examining the bill and listening to the debate, and I believe the bill is safe as framed. That the emergency must be met there can be no question, and I think the committee has met it very well. I shall be very glad to vote for the bill.

No expansion in the non-ferrous section of the War Industries Board is anticipated under the reorganization. Pope Yeatman, the head of that section, while expecting some increase in the volume of work which must be done, does not think that it will be necessary to add materially to his existing organization.

So large a proportion of ocean tonnage uses water ballast as to render negligible the claim of many importers of minerals that these commodities occupy no cargo space, simply serving as ballast. This is the conclusion reached by F. W. Paine, who investigated the problem for the committee on Mineral Imports and Exports.

Money Talks. Make It Holler For the 27th

Every little bit added to what we have will make just a little bit more—for the mining regiment. Watch the list of contributors grow. The Comfort Fund is a thermometer that registers the warmth of the mining industry's regard for its regiment. Heatless Mondays are over, the mercury is rising, and the weekly clean-up boosted the fund $1465 higher. Hats off! It is getting warm. From now on, the total should rise rapidly. It won't unless you help, but it must if the Comfort Fund is to fulfill the purpose that its name implies.

The ladies of the Woman's Auxiliary of the A. I. M. E. are doing their bit for the regiment, and a big little bit it is. Thus far they have sent in 134 sweaters, 246 pairs of socks, 88 pairs of wristlets, 80 helmets, 2 mufflers, 2 trench caps and 24 comfort kits. This work is engineered by their Emergency Committee, of which Mrs. H. Norman Spicer is chairman, Mrs. Karl Eilers treasurer, and Miss Olga K. Ihlseng secretary.

Take a moment and glance at the thermometer:

Engineering and Mining Journal	$1000.00
New York Engineering Co.	1000.00
A Friend, Nov. 23	5.00
H. H.	5.00
D. E. Charlton	5.00
H. W. Hardinge	1000.00
Frank N. Spencer	5.00
W. L. Coursen	5.00
J. H. Polhemus	5.00
J. H. Janeway	10.00
Albert D. Beers	10.00
J. E. Hayes	10.00
J. A. Van Mater	25.00
L. Vogelstein & Co.	100.00
"Cuprite"	10.00
R. H. Bassett (Hanna Ore Mining Co.)	10.00
A Friend, Dec. 10	10.00
P. A. Mosman	10.00
American Zinc, Lead and Smelting Co.	100.00
J. G. H.	5.00
Daniel Guggenheim	100.00
A. H. H.	5.00
Willard S. Morse	25.00
August Heckscher	100.00
Anaconda Copper Mining Co.	1000.00
F. W. Bradley	100.00
Charles Le Vasseur	5.00
A Friend, Dec. 13	50.00
Freeland Jewett	10.00
Herman A. Wagner	5.00
Francis P. Sinn	10.00
R. C. Gosrow	5.00
D. C. Jackling	100.00
"V"	10.00
J. H. Brickenstein	5.00
E. E. Northrup	5.00
Rogers, Mayer & Ball	50.00
Denver Technical Staff, American Metal Co., Ltd.	30.00
A Friend, Jan. 9	100.00
E. B. Coolidge	10.00
J. V. N. Dorr	200.00
Pope Yeatman	50.00
W. H. Aldridge	50.00
C. E. Hart	5.00
Robert I. Kerr	5.00
Engineers of Washoe Smeltery, Anaconda Copper Mining Company	205.00
Harry C. Graham	25.00
Utah Copper, Nevada Consolidated, Ray Consolidated and Chino copper companies	1000.00
A Friend, Jan. 23	5.00
John Gillie	25.00
J. N. Houser	5.00
C. K. Lipman	50.00
Theodore Sternfeld	50.00
Clinton H. Crane	500.00
T. Wolfson	10.00
William H. Hampton	10.00
W. E. Merriss	10.00
J. Parke Channing	100.00
Miami Copper Co.	250.00
J. H. Means	10.00
C. W. Goodale	25.00
P. G. Beckett	50.00
F. R. Foraker	25.00
Charles A. Chase	25.00
E. Fleming L'Engle	5.00
Calumet & Hecla Mining Co.	250.00
H. G. Ferguson	18.00
ay E. Van Gundy	10.00
Franklin Osborn	10.00
Oscar Lachmund	10.00
W. T. Swoyer	10.00
nterest	10.00
Quincy Mining Co.	100.00
American Metal Co.	250.00
William H. Fairbanks	25.00
D. E. Curry	5.00
W. R. Ingalls	50.00
H. A. Guess	25.00
J. Mc. C.	5.00
Engineers' Club of Northern Minnesota	85.00
S. B. Thayer	50.00
R. H. Sales	25.00
Albert C. Burrage	100.00
Edward H. Clark	25.00
P. Rutherford	5.00
Adolph J. Martinson	2.00
Frank R. Edwards	5.00
C. H. Munro	100.00
E. E. McCarthy	25.00
J. L. Bruce	15.00
D. Ford McCormick	10.00
Louis D. Huntoon	5.00
P. G. Spilsbury	10.00
C. T. Brown	10.00
M. C. M.	3.00
James F. McCarthy	50.00
United States Smelting, Refining and Mining Co.	250.00
L. O. K.	10.00
Herman A. Prosser	25.00
J. E. Johnson, Jr.	5.00
A. W. Hahn	5.00
L. D. Hudson	10.00
Lane Pearl	5.00
Arthur K. Adams	10.00
L. L. Wilcox	5.00
E. J. Longyear Co.	100.00
Pick and Shovel Club, Mining Department, Case School of Applied Science	11.00
L. S. Cates	25.00
J. M. Platt	25.00
A. L. Walker	5.00
C. G. Rothschild	10.00
General Engineering Co.	25.00
N. O. Lawton	10.00
F. R. Weekes	10.00
S. F. Shaw	10.00
Iowa Gold Mining and Milling Co.	50.00
L. L. Middelkamp	10.00
G. C. Townsend	10.00
H. S. Monroe	10.00
Jesse Scobey	10.00
J. H. McCormick	10.00
William Young Westervelt	50.00
B. Britton Gottsberger	50.00
Oscar Lachmund (second contribution)	10.00
L. R. Budrow	10.00
Horace V. Winchell	50.00
W. J. Pentland	10.00
Dome Mines Co.	50.00
Butte Copper and Zinc Co.	100.00
Eagle & Blue Bell Mining Co.	100.00
William A. Nicholls	10.00
Robert S. Lewis	10.00
Earl R. Pembroke	10.00
East Butte Copper Mining Co.	50.00
Job H. Winwood	10.00
Fred Hellmann	50.00
B. Elkan	50.00
Judd Stewart	10.00
R. M. Raymond	50.00
J. Allen McKay	10.00
C. E. Hart (second contribution)	5.00
C. J. Trauerman	5.00
Thomas H. Garnett	5.00
Robert E. Dye	10.00
Louis Ross	25.00
Willis B. Parsons	5.00
Rukard Hurd	10.00
Rembrandt Peale	1000.00
Walter Fitch, Jr.	100.00
George J. Young	25.00
Robert Franke	10.00
F. C. Bowman	25.00
Oscar Lachmund (third contribution)	10.00
Charles McKinnis	20.00
C. P. Carlson	10.00
Harry E. Hall	5.00
James Douglas	250.00
Total	$11,924.00

Make your checks payable to W. R. Ingalls, treasurer of the Association of the 27th Engineers. Because of the work involved in administering the Comfort Fund, contributions are acknowledged only by publication in the *Journal*.

Consideration of the Mineral-Control bill by the House began late on Apr. 23.

"Volatile Platinum" is now the successor of the "volatile gold" fake. Unscrupulous assayers of the Northwest began reporting "volatile" or "colloidal" platinum in the sand of the Deschutes and the Crooked Rivers in Oregon and caused some local excitement. The U. S. Geological Survey sent Henry G. Ferguson into this area to make an investigation, and has now issued a warning to prospectors with reference to sands that do not show native platinum.

Monthly Copper Production for 1918

This table is compiled from reports received from the respective companies (except in the cases noted as estimated), together with the reports of the United States Department of Commerce as to imported material, and in the main represents the crude-copper content of blister copper, in pounds.

As pointed out in an editorial in the *Journal* of Apr. 20, we have improved our system of reporting monthly copper production. Notwithstanding the increased completeness of these reports, the present monthly figures will be regularly too high; i.e., their aggregate will exceed the figures reported by the same companies for the whole year, for the following reasons:

1. The probability that some companies report blister copper instead of fine copper contents thereof.

2. Non-allowance for loss in smelting in the case of the porphyry mines that report concentrate, and non-allowing for loss in refining in other cases.

3. Duplication of imported copper, which is included to some extent in the figures reported by American smelters and is also included in the statement of copper imported.

On these accounts the monthly figures will regularly be too high, perhaps as much as 5%. Being computed from month to month on the same basis, however, they will be properly comparable, and will be reliably informing, with the understanding that they involve a regular "plus" error.

MONTHLY CRUDE COPPER PRODUCTION, 1918

	Jan.	Feb.	Mar.	Apr.
Alaska shipments	6,131,821	6,249,456	8,014,059	.....
Arizona:				
Arizona Copper	2,500,000	3,600,000	4,000,000	.....
Cons. Ariz. Smelting	1,820,000	1,780,000	2,270,000	.....
Inspiration	5,000,000	6,200,000	8,750,000	.....
Magma	560,000	800,000	900,000	.....
Miami	4,709,483	4,502,905	5,174,365	.....
New Cornelia (*a*)	2,374,000	2,522,000	3,218,000	.....
Old Dominion	3,400,000	2,841,000	2,872,000	.....
Ray	7,571,000	6,860,000	7,585,000	.....
Shannon	972,000	788,000	962,000	.....
Shattuck Arizona	849,440	854,042	1,013,593	.....
Other Arizona	31,232,643	28,587,020	29,575,371	.....
California:				
Mammoth	1,620,000	1,370,000	1,620,000	.....
Michigan:				
Calumet & Hecla	12,140,197	12,077,320	13,784,569	.....
Other Lake Superior (*b*)	7,000,000	7,000,000	7,000,000	.....
Montana:				
Anaconda	24,900,000	24,100,000	28,000,000	.....
East Butte	2,574,140	2,324,040	2,395,940	.....
Nevada:				
Mason Valley	1,536,600	1,253,000	1,455,200	.....
Nevada Cons.	6,500,000	6,250,000	6,060,000	.....
New Mexico:				
Chino	7,590,244	5,882,581	7,833,046	.....
Utah:				
Utah Copper	13,500,000	11,900,000	16,380,000	.....
Eastern smelters (*b*)	1,750,000	1,750,000	1,750,000	.....
Total reported	146,231,568	139,491,364	160,613,143	.....
Others, estimated	19,200,000	20,520,000	.....	.....
Total United States	165,431,568	160,011,364	.....	.....
Imports, ore and concentrates, etc	9,288,153	14,996,443	.....	.....
Imports in blister, etc	34,513,165	41,016,225	.....	.....
Grand total	209,232,886	216,024,032	.....	.....
British Columbia:				
Canada Copper Corpn.	445,268	336,000	.....	.....
Granby Cons.	4,209,393	3,843,686	2,977,713	.....
Mexico:				
Boleo	1,576,400	1,576,400	1,631,500	.....
Cananea	3,130,000	3,960,000	4,480,000	.....
Other Foreign:				
Braden	6,200,000	4,754,000	5,248,000	.....
Cerro de Pasco	6,598,000	5,332,000	6,966,000	.....
Chile	8,358,274	.....	.....	.....
Cape Copper	.....	.....	.....	.....
Kyshtim	.....	.....	.....	.....
Katanga	4,519,430	2,645,520	3,086,440	.....

(*a*) Only electrolytic cathodes are entered. New Cornelia also produces some copper from ores sent to Calumet & Arizona smeltery, which is included under "Other Arizona." (*b*) Estimated.

The grand total includes, under "Imports in ore and blister copper," the production of such companies as Canada Copper, Granby, Cananea, Braden, Cerro de Pasco and Chile. As a matter of record, however, the individual figures are given after the total. We also report the production of the Boleo, Cape Copper, Kyshtim and Katanga companies, whose copper does not come to the United States.

The item "Alaska shipments" gives the official figure of the United States Department of Commerce. Kennecott production for January, February and March was 5,970,000, 5,888,000 and 5,772,000 lb., respectively.

No Lagging of Mining Industries in Liberty Loan Campaign

That the mining industries purpose to do their share in the Third Liberty Loan drive is evident from the results thus far obtained by the Rainbow Division of the Special Liberty Loan Committee for the Mining Industry, of which Charles Hayden is the chairman.

The following list, complete to Apr. 22, shows what has been accomplished by the mining committee in securing subscriptions for Third Liberty Loan Bonds:

Utah Copper Co.	$3,000,000
New Jersey Zinc Co.	1,110,450
Chino Copper Co.	1,000,000
Nevada Consolidated Copper Co.	1,000,000
Ray Consolidated Copper Co.	1,000,000
Phelps Dodge Corporation	1,000,000
International Nickel Co.	750,000
Greene Cananea Copper Co.	500,000
United Verde Extension Co.	500,000
Cerro de Pasco Mining Co.	500,000
Minerals Separation North American Corporation	500,000
James Douglas	400,000
Butte & Superior Mining Co.	250,000
Arthur C. James	250,000
Magma Copper Co.	200,000
L. Vogelstein & Co.	250,000
Van Dyke Smelting and Refining Works, Inc.	110,000
Consolidated Copper Mines	100,000
Beer, Sondheimer & Co., Inc.	175,000
Homestake Mining Co.	100,000
Utah Consolidated Mining Co.	100,000
American Zinc, Lead and Smelting Co.	100,000
Oriental Consolidated Mining Co.	90,000
Mason Valley Mines Co.	50,000
Buffalo Mines, Ltd.	50,000
Quincy Mining Co.	50,000
Butte Copper and Zinc Co.	50,000
Grand Reef Mine, R. V. Dey, owner	45,000
Ledoux & Co.	20,000
North American Copper Co.	20,000
First National Copper Co.	10,000
Copper Canyon Mining Co.	10,000
Albert Ledoux	7,200
Dexteretta Mines	5,000
Horn Silver Mines Co.	5,000
Ponupo Manganese Co.	5,000
C. M. Garrison	1,500
J. R. DeLamar	500,000
August Heckscher	50,000
Balaklala Consolidated Copper Co.	10,000
St. Joseph Lead Co.	100,000
Howe Sound Co.	400,000
John Hays Hammond	50,000
D. M. Steindler (Dominion Red. Co.)	12,000
Consolidated Arizona Smelting Co.	25,000
American Metal Co. and its officers	1,000,000
Bates Iron Co.	15,000
Florence Iron Co.	10,000
Jas. McLean	250,000
Nipissing Mines Co.	250,000
Granby Mining and Smelting Co.	250,000
Anaconda Copper Mining Co.	2,900,000
Inspiration Consolidated Copper Co.	1,000,000
United Metals Selling Co.	8,500
Total	$20,144,650

Editorials

The Situation in the Zinc Industry

IN VIEW of the critical situation in our zinc industry, wherein conditions seemed to be approaching a crisis, we requested the several smelters and electrolytic producers to report to us some data for the first quarter of 1918, in order that the exact status of affairs might be ascertained.

These reports showed a production of 136,171 tons in the first quarter of 1918, compared with 153,296 tons in the previous quarter. The stock in the hands of smelters on Apr. 1 was 64,442 tons, compared with 60,415 tons on Dec. 31. Of the production in the first quarter of 1918, 128,075 was the output of smelters, and 8096 was the output of four electrolytic producers. The smelters who produced during the first quarter had a total of 195,246 retorts, of which 124,104 were in operation on Apr. 1. Operating smelters reported a total of 196,560 retorts in December, 1917, with 127,193 in operation on Dec. 15, 1917. We may assume that about 125,000 retorts, on the average, were in use during the first quarter of 1918, and that their product was at the rate of a trifle more than four tons of spelter per retort per annum.

At first sight these figures might appear somewhat paradoxical, for they show almost as many retorts in operation on Apr. 1, 1918, as there were on Dec. 15, 1917, although there has been lately a good deal of talk of smelters suspending and curtailing operations, and it is well known that some plants have been closed. On the other hand, there were two new plants that came into operation in the first quarter, these being the tail end of the new construction instituted in 1917; while some other plants that began smelting in 1917 completed their construction and put additional furnaces into operation early in 1918. Furthermore, certain smelters who during March announced closing had not actually done so by the end of that month, being engaged in working off accumulations of ore. Several of these plants will become cold during April, and a report of date May 1 will surely show much less smelting capacity in use than on April 1.

We do not regard the statistics of the first quarter of 1918 as revealing a situation so bad as had previously been conjectured. The production of 136,000 tons in a quarter is still a very large production; and that, in the face of it, stocks in smelters' hands accumulated only 4000 tons, is not a very bad showing. On the other hand, there is no doubt that the quantity of spelter in transit was considerably larger than three months previously, and a good deal of the recent dullness in the market is explainable by consumers getting their supplies from railway deliveries, theretofore delayed, and not being obliged to enter into new contracts right away.

On the other hand, the real curtailment in production is yet to come, the curtailment that is to ensue from the driving out of business of the last group of uneconomic plants, plants that are uneconomic either due to antiquated construction, to increased cost of gas supply, or otherwise. The final step, however, and the one that will ultimately control the situation, is the position of the mines. Strange as it may sound, in view of the depressed state of the market, there have been smelters, and not only those who make sulphuric acid as a by-product, who have been able to sell spelter at 6¾c. and buy the ore out of which to make it at such a margin as to leave a profit. So long as they can do that, those smelters will naturally continue to operate, and it will be for the miners to say when they can no longer afford to sell ore. The mines of the old sheet ground in Webb City are, of course, out of it now; but the new mines of Miami, Okla., yielding 10% blende, and even more, are able to earn money at present prices. These mines may reduce the entire zinc industry to a lower plane of prices, the most potent determinative factor in the cost of production being the grade of the ore produced in the first place. The fact that some of these mines are being gutted by inexperienced and short-sighted operators will not detract from their effect on the market in the near future.

Another factor that is maintaining operations by the zinc smelters and consequently supporting ore prices, or, we might better say, delaying the decline in ore prices, is the insatiable demand for sulphuric acid, which causes the zinc-acid producers to pay what is in effect an increased amount for the sulphur value of the blende that they buy.

The stock of spelter that the smelters are now carrying is not phenomenally large, although some may think so, owing to the zinc industry not being used to the idea of anything but a relatively trifling supply. In fact, however, the present stock is only about the production of a month and a half. It is to be observed further that, whereas there were formerly many weak interests in the zinc business, the latter is now in the main in the hands of strong interests, although they are numerous and competitive. However, they are not of a sort to be forced into selling, as were many in former days.

On the whole, we think that the decline in zinc has already gone too far; yet it is not unlikely to go even further, until a few more of the less favorably situated plants and mines are put out of business. But the further the decline goes from now on, the sharper will be the upturn a little later.

The Increased Cost of Living

THERE has been much loose talk respecting the increased cost of living since the beginning of the war. This has been one of the favorite arguments of labor agitators in demanding repeated increases in wages, which have been meekly granted owing to the fundamental condition that the supply of labor is short

and the need for having work done is urgent. Nor is it to be maintained that such claims have always been destitute of merit. On the contrary, there are many employments, those by public service corporations, for example, that, having failed to enjoy any increased income, have been unable to raise the wages of their men, who found it really difficult to cope with an increased cost of living that was in no wise illusory. Nevertheless, they, together with the many workers who were in no such unfortunate predicament, have learned to believe that the extent of the increased cost is a great deal more than it really is. Talk about a doubled cost was manifestly ill-informed and idle. Indeed, there has been a lot of buncombe preached about this subject.

We have intimated such a conjecture in previous articles. A recent report by a committee of economists appointed by the Secretary of the Treasury summarized the advance in wholesale commodity prices from the middle of 1914 to the end of 1917 by the factor of 1.81, while the enhancement of retail prices in the same period was only 1.57. It would be an unnecessary digression to point out the reasons for the difference between the wholesale and retail indices, but, commenting on these figures, we suggested that if the increase in retail prices was 1.57, the increase in the cost of living must be less, for it is well known that important elements in the cost of living, such as rents, have risen less than the retail prices for commodities, while some things, such as the use of public services, have not risen in cost at all.

This conjecture, or rather deduction, finds confirmation in the report of the U. S. Bureau of Labor Statistics respecting the increased cost of living in the New York shipbuilding district, which was issued a few weeks ago. The actual expenditures of 608 families in 1917 were obtained, analyzed and summarized. It appeared that from the middle of 1914 to the end of 1917 the cost of clothing had increased by 51.4%, of furniture and furnishings by 56.47%, and of food by 55%. The close agreement between these figures and the summary of the Treasury economists for all retail prices is striking. Miscellaneous expenditures increased by 44.68%, fuel and light by 19.92%, and housing by only 2.6%. Inasmuch as rent constituted 13% of total expenditures, and fuel and light 20%, the average increase in the cost of living in this district must have been about 40 per cent.

The seriousness of such an increase is not to be minimized. Particularly is it serious for the class of workers who are obliged to live on salaries that have not been raised in like proportion. Yet it is possible—nay, it is likely—that the proportional increase of cost to families living on a $2500 scale is not so high as to those living on a $1350 basis, which was the average expenditure of the 608 reported by the Bureau of Labor Statistics. But, anyhow, there is a big difference between an increase of 40% in the cost and the 100% that has been carelessly and incorrectly talked about.

We have shown in another article that a comparison between the most illuminating American index number for labor and the indices for wholesale commodities testifies that average earnings of labor have risen in about the same ratio as the wholesale prices for commodities. It follows from this that average earnings, and average wages even more so, have risen much more proportionately than the cost of living. It is sometimes alleged that statistics are apt to be misleading, which is a way of saying that statistics supposed to represent the whole of a case do not do so in fact. But that these statistics do truly represent the general nature of events is evidenced by the notorious observation in many works that many men who used to work six days per week are now working only four, or even less. The simple meaning of this is that men who formerly had to work six days to obtain the food, clothing and housing that they need and want, are now able to satisfy their needs and wants by the labor of fewer days. This is simply a different and less exact way of saying what we deduce from the statistics.

Nor are the experience and misunderstanding unique to America. There has been a general belief in Great Britain that the cost of living there also had increased by 105% since the outbreak of the war, but Lord Rhondda stated, Jan. 3, 1918, that the cost of living had not gone up very much more than 50%, while during the last six months of 1917 it had actually decreased by 10%. On the other hand, the wages for all employed people of the United Kingdom in 1917 were between £400,000,000 and £500,000,000 more than in 1913.

At Last the Right Kind of Reports

IN NORMAL times the anthracite producers had an average working force of 177,000 men. The draft and other causes cut the number down to 152,000 in September, 1917. By the middle of February, 1918, the operators had succeeded in raising the force to 155,000. Even with this force, they are making about the same output of anthracite as in normal times. In other words, the men are working harder.

A press dispatch reported a few days ago that on the previous day a crew of five men employed by the Mobile Shipbuilding Co. had driven 1260 rivets in nine hours, and it was asserted that this was about twice the number ordinarily driven by such a crew. We do not know whether this was a "best on record" in riveting in shipbuilding, or even whether the work was as much as a crew of five men ought to do, but the report exhibits the right kind of spirit.

Let our workingmen appreciate what they are now doing; that it is work that counts. Let them be stirred by the spirit of emulation to get their respective jobs done as quickly as possible, and a little quicker than anybody else. Let this spirit prevail among all of us who are working behind the lines, and very soon it will be all up with the enemy.

The Coal Production of 1917

THE statistics of coal production in 1917 exhibited an increase as compared with 1916, but several times we have expressed wonder as to whether there was really an increase or not, referring to heat units. It is, of course, easy at any time to increase the production of coal and quasi-coal *ad libitum* by loading

slate with it, although that is hardly fair upon the overtaxed railways and helpless consumers.

We were not alone in this opinion. We recollect Mr. Storrow, the New England Fuel Administrator, being very outspoken about it, and we heard similar expressions privately in other official and well-informed quarters. Dr. Garfield himself has clinched the matter in an official statement, Mar. 31, given out from the U. S. Fuel Administration in its document No. 459, wherein he says:

> By carefully drawn regulations the Fuel Administration has insured the shipment of "clean coal" from the mines. Coal containing an undue amount of foreign matter will be penalized in price, and producers who take extraordinary measures in the preparation of their coal will be recompensed. These measures will keep off the railroads and out of the bins of the consumers a large amount of unburnable material which was included in last year's coal production.

We shall never know just how the coal statistics of 1917 ought to be compared with those for 1916, but there will not be any doubt that there was an insufficiency of carbon and a superfluity of ash in 1917, and that the messing up of the coal industry was in some way responsible for this. We never considered Dr. Garfield to be primarily responsible. The fundamental causes antedated him.

German Iron-Ore Production

REGARDING the specific question of Alsace-Lorraine, raised by Czernin, Ex-Foreign Minister of Austria, and Premier Clemenceau, of France, it is not hard to predict that the return of these provinces to France would mean a loss in iron alone to Germany that would have the effect of an economic calamity.

A conservative figure of the iron ore in German Lorraine estimates 1800 million tons, and the deposits cover an area of about 108,000 acres. According to the last obtainable figures, in 1913 Lorraine produced 21,135,554 tons, or 58% of Germany's total iron ore. During the same year France produced 21,500,000 tons, but fully 90% of this was produced from the Briey, Nancy and Longwy mining districts, whose deposits are estimated as 3000 million tons, and the greater portion of this area is now occupied by Germany. So it will be seen that the iron-ore production of German Lorraine alone is equivalent to that of the entire French production.

According to a Socialist member of the German Reichstag, Germany would not be greatly distressed should a portion of German Lorraine be ceded to France, if it was necessary to procure peace in that way, but the opposition differs, realizing that a loss of four-fifths of natural wealth so essential to the continuance of the fighting power of Germany would be very serious.

A Shipbuilder To Build Ships

"THE animadversions of certain people on the 'settlement workers,' and 'radicals' and 'professors' among the advisers of the Administration must bring joy to many an honest heart," wrote a gentle lady to a newspaper a few days ago. "I have been convinced that the real reason for the criticism of the Administration was dissatisfaction with its personnel. The critics think sincerely that no men who are not of 'big business' can possibly organize and run the great war machinery."

Yes, Madam, that is just about it. We should hate to set out to cross the Atlantic in the "Leviathan" with a professor of geology in command on the bridge and with a politician as first officer. We should be mightily afraid. Modern warfare has to be backed by the biggest business that anybody ever conceived, and therefore we have had a feeling that men experienced in handling big things should be doing them for us.

The calling of Mr. Schwab to the job of building our ships marks an epoch in our prosecution of the war. A shipbuilder to build ships! And the greatest shipbuilder of all. This was a great thing for the President to do. It was electrifying. In its inspiration of confidence it was worth a great victory in the field. Now we know that we shall not fall down in the crucial part of our program. The vitality and experience of this man, not merely an executive but an administrator, are the guaranty. What care we if he be the head of a great steel company, a shipbuilding company? That's what he ought to be. And within 24 hours he starts moving the shipbuilding administration away from the atmosphere of Washington!

BY THE WAY

No patent has been issued to Garabed Giragossian for his "free energy generator." A report to the effect that such a patent had been issued led to inquiry at the Patent Office. In reply J. T. Newton, the Commissioner of Patents, writes as follows:

> The Patent Office has not issued a patent to Garabed on his supposed invention. We have numerous applications for such things. In fact we get them almost daily, but as they are against demonstrated scientific principles, we refuse to grant patents thereon on the same ground, for example, that we refuse to grant patents for perpetual motion.
>
> I am sorry so much publicity has been given to this case, because it has a tendency to give a wrong impression of inventors as a class. They have done more for progress in America than has any other class, and Garabed Giragossian is the exception and is not characteristic.

There is not much mystery, says the *Times*, in the dislike of "experts" that is felt and expressed by not a few people. The expert is a man who goes to other men and tells them that the way in which they are doing their work is not the best way—that it is a bad, costly, or even stupid way—and that if they will only listen to him and follow his advice their work will be improved and their efficiency increased. None of us takes pleasure in hearing talk of that sort, and the displeasure is greater in exact proportion with length of the hearer's training and experience in conducting his business, trade, or art. All that the expert says carries the implication of adverse criticism directed against the recipient of his suggestions, and usually it is criticism of that recipient's father and grandfather. Of course that is resented, and the resentment is bitterest when the expert goes ahead and gives undeniable proof that his new way of doing things is better than the old ways which have long been productive of honor and profit. The expert, too, is always open to the convenient charge that he is not "practical"—that he is a man of theories and fads. Sometimes the charge is true—but only of the expert who claims the name without deserving it.

Personal

Have you contributed to the Association of the 27th Engineers?

Bulkeley Wells was in Silver City, Colo., recently.

R. S. Dean is acting head of the department of metallurgy at the University of Pittsburgh.

W. R. Allen, president of the Boston & Montana Development Co., has been in Butte on business.

E. Gybbon Spilsbury has returned from Cuba, where for the last two months he has been studying the manganese situation.

George E. Bent was appointed manager on Apr. 1 of the Chateaugay Ore and Iron Co., with office at Lyon Mountain, N. Y. **J. H. Cartwright**, superintendent, has resigned. Mr. Cartwright has been in charge of mining operations at Lyon Mountain for the last 12 years.

H. D. Miser, of the U. S. Geological Survey, is making a geological survey of the Batesville manganese field in Arkansas.

W. J. Richards, head of Corrigan McKinney & Co.'s interests at Crystal Falls, Mich., has returned from the south, where he spent the winter.

S. B. Elbert, manager of the Nevada United Mines Co., near Ely, Nev., recently returned to the property from Salt Lake and Denver.

Leroy A. Palmer has resigned as mineral examiner, U. S. General Land Office, to take a place as field engineer with the Suffern Co. Inc.

James Furman Kemp is president of the Rico Oil Co., New York. **Pope Yeatman** is vice president and **Herman Garlichs**, secretary and treasurer.

T. J. Flynn, recently manager of the Minaker mine, Kirkland Lake, Ont., has been appointed manager of the Otisse property, in the Fort Matachewan gold area.

Capt. W. H. Wright, of the Malm-Wolf Co., Denver, Colo., has been assigned to active duty, effective Apr. 27. He will proceed to Camp Lee, Petersburg, Virginia.

Charles Briggs, president of the Calumet & Arizona Mining Co., will return to his home in Calumet, Mich., about May 15, after wintering in California.

G. H. Dormer, superintendent of the Fayal district of the Oliver Iron Mining Co., has been transferred to the Virginia, Minn., district and will have charge of the Alpena mine.

James A. Boyd, recently manager of the Edmonton branch of the Imperial Oil Co., has been given charge of the company's business in Manitoba, with headquarters at Winnipeg.

B. H. Smith, of the Southern Manganese Corporation, of Birmingham, Ala., was in Butte, Mont., recently to superintend the loading of manganese ore for shipment to his company.

J. H. Stovel has resigned as inspector of mines at Sudbury, Ont., and has gone to Bessemer, Ala., where he will be in charge of E. J. Longyear Co.'s shaft-sinking contracts in that district.

Herman Garlichs, consulting metallurgist, of Brooklyn, N. Y., has left for a trip to British Columbia and the Pacific Coast to investigate some metallurgical problems in the Pacific Northwest.

Clifford A. Barabee, formerly mining engineer for the Cleveland-Cliffs Iron Co., at Gwinn, Mich., has moved to Iron River, Mich., where he is chief engineer for the Bates Iron Company.

Dr. J. I. D. Hines, of Lebanon, Tenn., has been appointed chemist of the Tennessee State Geological Survey, succeeding **Dr. Paul C. Bowers**, who has gone to Washington into Government service.

Albert Sauveur, professor of metallurgy and metallography at Harvard University, has been granted a leave of absence in order that he may continue his research work for the French government.

Charles W. Renwick, general manager of the Ducktown, Sulphur, Copper and Iron Co. Ltd., Isabella, Tenn., has resigned on account of ill health and is succeeded by **William F. Lamoreaux**, formerly assistant general manager.

H. Kenyon Burch has been appointed consulting engineer of the concentrating department of the Phelps Dodge Corporation, to be in charge of the design and construction of the 3000-ton concentrating plant of the Copper Queen branch, at Bisbee, Arizona.

Dr. F. B. Laney, who is in charge of the microscopical laboratory of the U. S. Bureau of Mines, at the University of Utah, and his assistant, **R. E. Head**, have been ordered to the Pittsburgh station of the bureau to do work for the ordnance branch of the War Department.

John T. Milliken has succeeded **Jasper T. Robertson** as manager of the Afterthought Copper Co., operating at Ingot, Shasta County, Calif. Mr. Milliken will devote considerable time to perfecting the company's flotation plant. Mr. Robertson will return to his home in St. Louis.

John Gillie, general manager of mines of the Anaconda Copper Mining Co., attended the Americanization Conference in Washington, recently called by Secretary Lane. Mr. Gillie represented the Butte Chamber of Commerce. En route home, he stopped at Chicago to attend the annual convention of the U. S. Chamber of Commerce.

Robert M. Linton, general manager of the Copper Mines Co., at Kimberly, Nev., recently visited Kimberly in company with **Edwin J. Collins**, of Duluth, Minn., who spent about a month in examining the property. **H. S. Munroe**, local manager of the company at Kimberly, expects to be called for service soon in the Army as an officer, as does also **Lindsay Duncan**, who has been engaged recently on the company's power problems.

Walter A. Funk, of Idaho Springs, Colo., and **Harry J. Wolf**, of Denver, have been serving as witnesses in the case of the Square Deal Gold Mining Co. vs. the Colomo Mining Co., involving title to the Notaway mine, in Gilpin County, Colo. A verdict has recently been rendered in favor of the plaintiff. Mr. Wolf also examined uranium and vanadium properties in Huerfano County and manganese and silver properties in Custer County recently.

Senator Charles B. Henderson, of Nevada, chairman of the Senate Committee on Mines and Mining, was born at San Jose, Calif., on June 8, 1873. He is a grandson of L. R. Bradley, who was governor of Nevada from 1871 to 1879. A graduate in law of the University of Michigan, he has been engaged in practice since 1900. He was district attorney for two terms, served one term in the Nevada Legislature and was elected regent of the University of Nevada for the 10-year period expiring Jan. 1, 1917. He was only recently appointed to the Senate by Governor Boyle, to fill the vacancy caused by the death of Senator Francis G. Newlands. He took his oath of office on Jan. 24 last. His home is in Elko, Nevada.

Obituary

Ernest Haycock, professor of geology at Acadia University, Wolfville, N. S., died on Apr. 13 aged 50 years. He was graduated at Acadia in 1896 and from Harvard in 1898, in which year he received his appointment at the former university.

Alexander Kelso, a North Ontario pioneer and prospector, died recently at Iroquois Falls from heart failure, aged 61 years. He founded the townsite of Kelso on the Temiskaming & Northern Ontario Ry., and was the owner of the land on which the Alexo nickel mine was discovered, from the development of which he realized considerable wealth.

Charles Louis Laforgue, managing director of the Compagnie du Boleo, Santa Rosalia, Baja California, Mex., died at his residence in Paris, at 19, rue de Pomereu, on Jan. 6, 1918. M. Laforgue came to this country to study American ideas and methods. Under his able management the Boleo company became an important producer. He was also managing director of the Compagnie d'Inguaran, manager of the Compagnie de Huaran and of the Société des Grands Moulins de Corbeil, and president of the Société de Touage et de Remorguage.

David Keith, president of the Silver King Coalition Mines Co., Park City, Utah, died on Apr. 16 in Salt Lake City, aged 71 years. He was born at Mabou, Cape Breton Islands, N. S., in 1847. At the age of 19 he made his way to California, via Panama, where he worked for a time in the gold fields, and later at Virginia City, Nev., where he became foreman of the Caledonia and Overman mines. In 1882, he went to Park City, becoming foreman of the Ontario mine. In 1885, Mr. Keith undertook the management of the Anchor Mining Co., now the Daly Judge, and was instrumental in placing that property on the road to success. With John Judge, he contracted to drive the Alliance tunnel, now a part of the Silver King Coalition workings. The development of this latter property brought Mr. Keith his final success. He was a member of the Alta and Commercial clubs, Elks' Club and Country Club of Salt Lake City, the California Club, Los Angeles; the Press Club of San Francisco, and the Rocky Mountain Club of New York. He is survived by his widow, three daughters and a son, David Keith, Jr., who is now with the expeditionary forces in France.

Societies

Engineers' Club of Northern Minnesota held its regular monthly meeting at Eveleth, Minn., on Apr. 20. Talks on road and street maintenance were given by R. W. Acton, C. M. Dorway and W. R. Van Slyke.

Utah Society of Engineers held its regular monthly meeting on Apr. 17 in Salt Lake City. A paper entitled "Electrolytic Separation of Zinc and Copper" was read by C. A. Hansen, of the General Electric Co.'s research laboratory. Members were invited to attend the local section of the American Institute of Mining Engineers.

Mining Institute of Scotland held its general annual meeting at Glasgow in the Royal Technical College on Apr. 6. The following officers were elected for the year 1918-1919: President, David M. Mowat; vice presidents, Thomas Arnot, Henry Briggs; councillors, Daniel Burns, William Caldwell, Hugh Johnstone, Joseph Parker, A. H. Steele and James W. Tweedie. Various papers were discussed.

Montreal Metallurgical Association held its annual meeting at McGill University, Toronto, Ont., on Apr. 10, when officers for the ensuing year were elected as follows: President, Prof. A. Stansfield; vice president, G. Percy Code; honorary secretary, James G. Ross; councillors, C. F. Bristol, George R. Kendall, William C. Lodge, H. J. Roast, Prof. J. Haynes, S. R. Kirkpatrick, W. G. Dauncey, F. G. Gardiner, B. A. McFarlane, and T. R. Davidson.

Société de Chimie Industrielle, New York section, met in Rumford Hall, 50 E. 41st St., New York, on Apr. 24. The following papers were presented: "Some of the Chemical War Problems," Prof. George A. Hulett, of Princeton University; "Condition of French Chemical Industries," M. F. J. Le Maistre, member of the visiting committee of American industries to France; and "Great Effort of the French Industries," M. Marcel Knecht, member of the French High Commission.

New Patents

United States patent specifications listed below may be obtained from "The Engineering and Mining Journal" at 25c. each. British patents are supplied at 40c. each.

Alloy of Steel with Ni, Mo, V and Mn. James Churchward, Lakeville, Conn. (U. S. Nos. 1,261,742; 1,261,743; Apr. 2, 1918.)

Flotation—Concentration Process. Walter A. Scott, Chicago, Ill. (U. S. No. 1,261,303; Apr. 2, 1918.)

Flotation—Process of Foam Reduction (Breaking Down Froth). Victor Zachert, San Francisco, Calif. (U. S. No. 1,261,671; Apr. 2, 1918.)

Grinding Mill for Ores and other Materials. William H. Janney, Hurley, N. Mex. (U. S. No. 1,261,398; Apr. 2, 1918.)

Metallic Sulphides, Process of Producing by Electrolysis. Charles Owen Griffith, Rockville, Wormit, Scotland. (U. S. No. 1,261,023; Apr. 2, 1918.)

Tungsten, Molybdenum—Process of Coating Tungsten or Molybdenum Articles with Precious Metals. Frank A. Fahrenwald, Cleveland, Ohio, dedicated, by mesne assignments, to the Government of the United States of America and to the People of the United States of America. (U. S. No. 1,261,110; Apr. 2, 1918.)

Zinc—Production of Zinc Chloride from Zinc Oxide. Frank K. Cameron and John A. Cullen, Salt Lake City, Utah, and Reed W. Hyde, New York, N. Y., assignors to American Smelting and Refining Co., Salt Lake City, Utah. (U. S. No. 1,261,695; Apr. 2, 1918.)

Zinc, Process for the production of. Otto Baltin, Lipine, Germany. (U. S. No. 1,261,342; Apr. 2, 1918.)

Editorial Correspondence

SAN FRANCISCO—Apr. 18

Mining in California is assuming wider and more varied proportions at present than ever before. The output for 1917, as estimated by the State Mining Bureau, will approximately double the value of the gold production which was recorded in 1852, the record year of the days when California's fame was based entirely on mining. State Mineralogist Fletcher Hamilton, through the medium of the bureau, has recently completed a series of county reports covering the mineral resources of all sections of the state in detail. Those desiring data of this kind are invited to make full use of the facilities of the Mining Bureau, which has headquarters in the Ferry Building, San Francisco. A letter addressed to the state mineralogist at that address will receive prompt and careful attention, and full information relative to any phase of mining will be gladly given wherever possible.

Production of Northend Comstock Mines for the week ended Apr. 6 totaled less than normal, owing to repairs in Union shaft, through which almost the entire output of the northend is hoisted. The total value of ore sent to mill amounted to $5477, of which Union produced $3402 and Con. Virginia $2075. A large amount of ore was broken and left stored in stopes. The Mexican mill crushed 128 tons of Union mine ore and 78 tons of Union dump material, having an average assay value of $18.14 and $13.84 per ton. Also 164 tons of Con. Virginia ore sampling $12.65 per ton. High-grade ore assaying as high as $279 17 per ton was disclosed in the main lateral drift of the Union, and another point in the vein on this level yielded 51 tons sampling $54.43. Ore was extracted from the 2400 and 2500 levels. The east crosscut in the 2300 level was advanced to the 91-ft. point from the southeast drift, the face showing 12 in. of quartz assaying $15 75 per ton. East crosscut in 2600 level advanced to the 58-ft. point from the south drift, the face in quartz and porphyry. Con. Virginia advanced No. 1 west crosscut on 2100 level 14 ft. to the 61-ft. point and No. 2 west crosscut 19 ft. to the 36-ft. point. The northeast drift in the 2700 level was advanced to the 107-ft. point. Mexican drove north in 2300 level, a distance of four feet, through low-grade quartz. Ophir began northwest crosscut in 2000 level to avoid caved ground near south boundary line. Sierra Nevada resumed work in the face of north drift, 2500 level; face in porphyry and quartz giving ore-grade assays. Jacket-Crown Point-Belcher, in the Gold Hill district, work continued in repairs to 360 station in Jacket shaft and first north drift advanced 14 ft. Winze sinking in Surface tunnel advanced three feet. Sent 370 tons of ore from shaft bins to mill glorvhole. Drew 246 cars low-grade ore from No. 1 chute and 56 cars from No. 3 raise chute. New equipment and repairs continued in mill; 78 tables operated 112 hours and old cyanide plant operated; 383 tons mine ore put into mill bins.

DENVER—Apr. 15

The Denver Section of the A. I. M. E. held a special dinner meeting on April 3, at the Denver Athletic Club, in honor of a visit by three of its officers Sidney J. Jennings, president; Charles W. Goodale, vice president, and Bradley Stoughton, secretary. President Jennings addressed the meeting on the various activities of the Institute in connection with the war. He described briefly the work that was being done by various committees and individual members who were giving assistance to the Government. He called attention to some of the important problems of mining that the Institute and its members were now facing and would have to consider after the war. He pointed out particularly the need of stimulating the production of those metals and minerals for which the Government was in special need at this time, viz. manganese, chromium, molybdenum, pyrites, sulphur, potash and nitrates. The second speaker of the evening was Secretary Bradley Stoughton, who called attention to the meeting of the Institute in Colorado next September, and made a plea for numerous professional papers from Colorado men for presentation at this meeting. He called attention to the changed conditions in the supply and demand for technically trained men in the Government service, and stated that at this time a place could be found for every technical man who desired to serve the Government, either without pay, or at a reasonable financial sacrifice. He said that he would be glad to receive communications from mining men and engineers who desired to give all or a part of their time to the Government in the interest of the successful prosecution of the war. Mr. Stoughton suggested that there was great value in bringing together the officers of the Institute and the members of the various local sections, and he proposed that the various local sections arrange to hold meetings each year at a certain time which would permit the officers to make a tour and meet these sections according to an efficient schedule. This proposal met with hearty approval on the part of the Colorado members. Attention was next called to a proposal to change the name of the Institute. It was explained that the present name did not seem to please all of the members, and that many groups of engineers who were engaged in metallurgy did not feel that they were properly covered by the present name. Some engineers are said to have taken the position that they feel they are misrepresenting themselves as mining engineers when most of their activity is entirely apart from mining. It was stated that the name "American Institute of Mining and Metallurgy" had been offered as a substitute for "American Institute of Mining Engineers." The suggestion caused some amazement among Colorado members, who appeared to resent the proposal almost unanimously. Only one member present, who is a metallurgist, had anything to say in favor of the proposal. Some of the older Western members who spoke against the change called attention to the value of an old and honorable name from both a sentimental and an historical standpoint. Others pointed out the futility of trying to select a name that would include and represent each individual technical pursuit. It was suggested that after satisfying the demand of a few of the metallurgists, there would remain the geologists, the mineralogists, the chemists, the assayers, and the numerous mechanical, civil, electrical and hydraulic engineers whose work was closely connected with mining operations. It was pointed out that mining is an extremely general term, and involves almost all other branches of engineering, and that no engineer had any reason to feel that he was overlooked, because the name of the Institute, naturally has a wide application. It was also objected that the proposed name would sound somewhat like that of the "Mining and Metallurgical Society of America" and that it was almost like a copy of the name of the much younger organization in London. One or two members who particularly resented the idea of the proposed change insinuated that there might be some mercenary motive behind the proposal, but this was denied by the officers. Vice president Goodale then spoke upon the problems in connection with labor and wages, and urged the necessity of paying particular attention to the problem of Americanization now and after the war. It appears that this problem has been neglected, presumably because of failure to realize that most of the increase in population in the United States is due to immigration. In view of the fact that the birth rate of the average immigrant family is higher than that of the American born family, the persistent neglect to regard the problem of Americanization seriously may become a source of grave danger in the future. Mr. Goodale called attention to the fact that most of the Western meetings of the Institute had resulted in the presentation and publication of many valuable papers which brought the mining and metallurgical records of the districts visited, up to date. It was suggested that Colorado members take advantage of the September meeting, and see to it that the records of Colorado mining and metallurgical practices be brought up to date. Tentative plans for the September meeting were discussed. These plans include visits to the Cresson, Portland, and Independence mines and mills in the Cripple Creek district, the metallurgical plants near Colorado Springs, the Colorado Fuel and Iron Company's steel works, and the lead and zinc smelteries at Pueblo, the Leadville district and vicinity, and numerous pleasure and sightseeing trips, including an automobile trip to the top of Pike's Peak. Arrangements will probably be made for one or more sessions in Denver.

SALT LAKE CITY—Apr. 16

The Fixing of the Price of Silver at $1 per oz. by the Federal Government, as proposed in the Pittman bill introduced April 9, will give further inpetus to the production of silver by this state, which in 1917 led in the output of this metal.

Wage Increases at Park City and Tintic recently made. At the former camp an increase of 25c. per day is effective from Apr. 1. Companies making the increase—which was voluntary—were: Ontario Silver, Judge Mining, Silver King Coalition, Daly West, Silver King Consolidated, Daly, and Park-Utah. Companies in the Tintic district that posted notices of the wage increase were: Chief Consolidated, Eagle & Blue Bell, Centennial-Eureka, Gemini, and Ridge & Valley. In this district also the increase was voluntary, and wages will be brought up to the standard of the mines in Bingham, the new scale going into effect the first of May. Other properties of the district, the Tintic Standard for example, are expected to follow. Companies controlled by the Knight interests will consider the matter at their regular monthly meeting, as will also the Loose companies and the Mammoth. Miners will be asked to vote on the question of the semi-monthly payment of wages as it is at present in force in Bingham, and if the sentiment is in favor of such a system, the men will receive their pay twice a month instead of every 30 days, as formerly. The present wages at Tintic are $4 for muckers, and $4.25 to $4.50 for machinemen.

Occupation Tax Affecting Lessees is being proposed by the state board of equilization, the rate proposed being 3% of net profits from operation. The board is sending a representative to the Tintic district to place the matter before lessees operating there and to collect figures of net proceeds, etc. The difficulty in imposing such a tax lies in the fact that many lessees are engaged in more than one leasing undertaking, some of which bring in a profit and some of which are a loss. It is felt that it would hardly be fair to tax each lease separately, when a lessee is operating several, as the final net profit to the operator or operating company would be lessened by the losing undertakings. Leasing in such cases should be regarded as any other business where there is profit and loss to be considered. Lessees are not required, as are mining companies, to hand in metal-production figures—although these would be of value—as it is recognized by the board of equalization that this class of operators are not in a position to give information of this nature. Lessees are asked merely to give a complete statement as to the amount received for their ore and a list of legitimate expenses which can be charged against operation.

BUTTE, MONT.—Apr. 17

Manganese Production in Montana has been greatly stimulated since the Anaconda Copper Mining Co announced its intention of constructing a plant for the treatment of these ores at Great Falls. Many mine owners have begun a hunt for manganese ore, and there is every indication that Butte will soon become a great manganese producing center and that South America, through lack of shipping facilities, will lose its hold on this trade after the war. It is the opinion of mining men that all the manganese required by the steel manufacturers can be produced in this country and that much of it will come from the Butte district.

Butte-Detroit Arranging for Extensive Production—A scheme is practically completed for consolidation of a number of manganese properties in the state and for

acquiring a rich manganese property in the State of Washington. This ore will be treated in the Butte-Detroit mill, formerly the Ophir. The Butte-Detroit mine is showing up ore rich in manganese. Above the 200 ft. level the pink manganese has disappeared and an immense body of rich black ore has been discovered. The vein is 18 ft. wide and at present is 400 ft. in length, exposing an estimated reserve of over 20,000 tons. The orebody outcrops at the surface and some already mined averaged as high as 50% manganese. The mill is being enlarged and the capacity will thereby be increased considerably within the next six weeks.

The Boston and Montana Development Co., which owns properties in the Elkhorn and French Gulch districts, has been continuing development work all winter, and it is understood that in the new vein opened up a short time ago there is considerable good-grade ore. The Montana Southern Railway Co., owned by the Boston and Montana Development Co., will be rushed to completion as soon as the weather permits. The right of way is graded to within about 10 miles of the end of the line, and as the ground is soft and the location practically straight it will probably not take long to complete. The management states that rails have been ordered and are to be delivered before the grading is finished. When the road is in operation, it is intended to start work on the mill, which is to be at the mouth of the tunnel and is to have a capacity of 500 tons per day. The president of the company is W. R. Allen, whose headquarters are in Boston. At this end the management is in the hands of John D. Pope, formerly manager of the North Butte company.

JOPLIN, MO.—Apr. 18

A Blast Furnace for Missouri Iron Ores is being planned by the Missouri Iron and Steel Corporation, a $6,000,000 organization. A $200,000 blast furnace at Jefferson, Tex., has been purchased and now is being dismantled and is to be re-erected on the Frisco railway line 10 miles southeast of West Plains and 2½ miles west of Brandsville, in Howell County, Mo. It is expected that the plant will be in operation early in 1919, and the company plans the production of several byproducts, including wood alcohol and sulphuric acid. After the blast furnace is placed in operation, the company also plans to install an electric furnace for the manufacture of steel. Three separate sites for electric power plants have been obtained by the company, which now has 20 iron properties, from one of which more than 350,000 tons have been shipped. W. R. Haight, of Brandsville, is president; Theo. F. Philips, of East St. Louis, is vice president; Frank J. Stuart, of St. Louis, is treasurer; Hicks Clark, of St. Louis, is secretary; J. C. Kingsbury, of West Plains, is superintendent of mines; C. E. Smith, of St. Louis, formerly chief engineer Missouri Pacific R.R., is director and consulting engineer, and John P. Marshall, formerly foreman Carnegie Steel Works at Braddock, Penn., and later superintendent Sligo Blast Furnace Co., is superintendent of furnaces.

PHOENIX, ARIZ.—Apr. 18

At a Joint Meeting held before the Governor by the Council of National Defense and Mine Operators, the charges made that the companies had imported "wobbles" to break up the union were not sustained.

WASHINGTON, D. C.—Apr. 23

The Government Is Looking for Men capable of taking charge of branch offices of the Bureau of Foreign and Domestic Commerce, Department of Commerce; also men to act as assistants in such offices. These branch offices are situated in the principal commercial cities, the salaries ranging from $1800 to $3000 for managers and from $1200 to $1800 for assistants. Applicants should write at once to the Bureau of Foreign and Domestic Commerce, at Washington, as a non-competitive examination will be held on May 16 in various parts of the country. Full details will be furnished upon written application to the Bureau. Applicants will be examined in export-trade technique, promotion of commerce, and economic geography, and credit will be given for knowledge of foreign languages. The examination will be given under the direction of the Civil Service Commission, but communications should be addressed to the Bureau of Foreign and Domestic Commerce.

VICTORIA, B. C.—Apr. 17

Proposed Mine Taxation by the Provincial government in British Columbia is causing considerable adverse agitation. When Hon. John Hart, Minister of Finance, explained the 1918 program, with reference to revenue and expenditure, to the Legislative Assembly, recently, he intimated that the two existing taxes, namely a 2% royalty on ore mined and a 10% tax on gross profits, would be maintained, but both would not be applied to any one mining company or individual miner. Collection would be made by government officials either under one or the other impost, that which would yield the greater revenue to the country in each instance being demanded. The Granby Consolidated Mining, Smelting & Power Co., Consolidated Mining and Smelting Co. of Canada, and the Canada Copper Corporation, Ltd., are the three companies which may be said to be making the strongest fight. The contention of the two former is that such an impost would practically wipe out the margin of profit on which they are operating. J. J. Warren, manager of the Consolidated Mining and Smelting Company, who was one of a representative committee which attended the mining committee of the Legislature, suggested that the 2% royalty on ore mined be continued and that the government impose any such super-taxes as it might find necessary to meet the financial requirements of the provincial administration. Oscar Lachmund, of the Canada Copper Corporation, declared that such a burden must have the effect of stifling development, and to substantiate the statement gave the financial history of his corporation. This company started with a capital of $5,000,000, practically all of which was paid up, and since its organization has paid dividends amounting to $600,000. The Copper Mountain property, low-grade copper deposit situated near Princeton, B. C., in the Boundary district, would not be in a productive stage for at least two years, and he is spending $1,500,000 in exploratory and development work, the company would have to lay out an additional $2,500,000 in plant equipment and railroad before returns could be expected. It is not yet known whether the representations made will have the effect of changing the government's policy.

The Mining News

ALASKA

ALASKA SHIPMENTS of domestic copper ore matte, etc., for the month of March to the United States were 21,096 gross tons; copper contents, 8,014,059 lb., valued at $1,183,032.

ARIZONA

Cochise County

AMERICAN SMELTING AND REFINING CO. (Willcox)—Turned over operation of Mascott properties to Mascott company on April 1. 35,000 tons of ore has been shipped.

BUNKER HILL MINES (Tombstone)—Erroneously reported as permanently closed. Portion closed only merely pending determination of new and better method of reduction for manganese ores.

HIGGINS MINING CO. (Bisbee)—Producing large quantities of manganese.

Gila County

MIAMI COPPER (Miami)—Has resumed full capacity operations. Enlargement of power house to be completed soon, adding two units each of 4000 kw. capacity.

Greenlee County

ARIZONA COPPER (Clifton)—Copper production in March 4,000,000 pounds.

Mohave County

CHLORIDE QUEEN MINING CO. (Chloride)—Big compressor soon to be ready. Company to sink main shaft to 400 or 500 level before drifting.

GOLD ROAD BONANZA (Oatman)—West drift advanced to 350 ft. and showing reported encouraging.

HACKBERRY SILVER (Kingman)—Understood to be letting contracts for a 200-ton mill, a power plant, offices, and bunk houses. M. McGee is manager.

RED GAP MINE (Kingman)—Optioned by Kean St. Charles to Eastern capitalists, and it is understood that work will begin on the property at once.

RICO MINES (Kingman)—To be financed. Three men and a team are now at work.

TOM REED (Oatman)—Drift on the bonanza orebody now at the 600 level and is reported to be still in rich milling ore. West Bald Eagle drift still in good ore over 400 ft. from crosscut. Gray Eagle also in commercial ore for a distance of 40 ft. Total length of ore exposed in Bald Eagle said to be 600 ft.

UNITED EASTERN (Oatman)—Big vein on the new eighth level now being opened up. A. Merrill vacuum precipitation machine installed on trial, the purpose being to reduce the zinc consumption.

Pinal County

SILVER KING (Florence)—Last 40 ft. of unwatering has reached harder ground, eliminating all future danger from caving. A 5-ft. streak of high-grade milling ore reported exposed recently on the 120 level; 25 men employed.

Yavapai County

ARIZONA-VIRGINIA (Prescott)—Bought from P. H. Johns 15 claims in Castle Creek district. E. C. King, of Humbolt, is managing director. Has 900 ft. of shaft and tunnels.

BIG LEDGE (Mayer)—Report of Superintendent Trebilcock for week ended April 1, states: Henrietta mine north drift on 150 level now in 817 ft.; north drift 300 level in 202 ft., showing average width ore for week of five feet. The south drift same level in 161 ft., with average width ore four feet.

COPPER CHIEF (Jerome)—Milling 60 tons of gold ore daily. Mill capacity, 100 tons.

DOS ORIS MINE (Prescott)—Cleaning out the old 750-ft. tunnel and to sink winze in vein. J. B. Tomlinson is in charge.

HACKBERRY MINE (Kingman)—Planning erection of large mill.

JEROME VERDE (Jerome)—For week ended March 26, 249 ft. of diamond drilling and 130 ft. of drifting on the 1110-ft. level was completed.

VERDE COMBINATION (Jerome)—Resumed sinking, and shaft now down 700 ft. Will be put down 200 or 300 ft. further. Monthly report shows 730 ft. of development underground in March.

Yuma County

BLACK GIANT MINES (Wenden)—Compressor started on the Little Giant property and sinking to proceed faster. Five cars of ore reported to have been shipped from the property in sinking 500 ft. and drifting.

CARMELITA M. & M. CO. (Salome)—Continuing steady development, and good results reported.

COPPER BELT (Salome)—Opened three strong veins said to contain gold, copper, and bismuth in good grades. Property temporarily shut down.

CRITIC CLAIM (Salome)—Leaser Nolachek working 12 to 14 men on 400 level.

LEADVILLE-ARIZONA (Wenden)—Organized to take over Tom Finnegan's property on south side of Harqua Hala Mountains. Work to be started soon.

ARKANSAS

Independence County

MANGANESE DEVELOPMENT (Cushman)—Building an experimental dry process mill in Chicago for saving fines. Large tonnage 17% manganese ore available if mill proves success.

POLK-SOUTHARD (Cushman) — Operated by Independence Mining company. Opening up new manganese deposit by steam shovel.

CALIFORNIA

Butte County

BLOOMER HILL (Oroville)—Reported purchase completed by California National Gold Mining Co. Contemplate installation of plant of 1500 tons daily capacity. Property developed by three tunnels. Lode said to extend width of 480 ft. Low-grade ore from $2.50 to $5 per ton. San Francisco men interested.

KEYSTONE (Oroville)—New vein disclosed in Oregon gulch. Equipped with 5-stamp and 3-stamp batteries ready to be put in commission immediately sufficient ore is available.

Inyo County

LONG JOHN (Lone Pine)—Optioned by Inyo Silver-Lead Syndicate. Recent disclosure silver-lead carbonate ore averaging $67 per ton. Formerly worked by Churchill and Maine, who sunk on narrow vein; ore worth $30 per ton. George Lewis and Dave Holland deepened shaft to 150 ft., the vein widening, and in the last 33 ft. the ore extends full width of the 8-ft. shaft, without disclosing walls. Have 500 tons of ore sacked. Mule pack train to be used from mine to wagon road about one mile; remaining five miles haul to Mt. Whitney station on Southern Pacific, ore to be hauled by motor trucks.

Lassen County

DESERT PRODUCTS CO. (Susanville)—Reported that potash deposit claims on shore of Honey Lake have been located and test wells 27 assays show material ranging from 4 to 40% potash salts. John P. Peterson and associates, including Dr. C. A. Jacobson, of the Mackay School of Mines, at Reno, form the company.

Nevada County

GOLDEN CENTER (Grass Valley)—Reported high-grade ore disclosed in recent development in 500-ft level at a point 600 ft. north of shaft. Vein highly mineralized and shows width of five feet. Company has made final payment on new territory recently acquired.

San Bernardino County

RADIO MINES CO. (San Bernardino)—Incorporated to develop and operate ore deposits in Ord Mountains said to carry gold, silver, tungsten and uranium. New process of treatment devised by R. C. Work to be installed. Company owns 90 claims and has arranged for extensive development.

Shasta County

AFTERTHOUGHT (Ingot)—About 140 men on payroll. Mine and flotation plant to be operated under management of J. T. Milliken.

BULLY HILL (Winthrop)—Reported Guggenheim interests made initial payment on this property, owned by General Electric Co., which is to receive royalty of 35% on all ore sales until final payment. Shipping 100 tons per day to smeltery at Kennett. Purchase price of property, including 15 miles of railroad from the mines to the Southern Pacific, said to be about $1,000,000. Old smeltery built by Delamar 18 years ago is being dismantled to make way, it is reported, for flotation plant.

SYBIL (French Gulch)—Mine and mill working regularly three full shifts, with 40 men on the payroll.

Tuolumne County

FEDERAL GOLD (Sonora)—Huntington mill of 50-ton capacity being installed. Compressors and other machinery being received. Expect to have plant in operation by summer. J. T. Harris is superintendent.

OGDEN CHROME (Sonora)—Since middle of December, 16 carloads of chrome and one carload of manganese have been shipped from property at Marsh Flat. Also six carloads of chrome from the Mackey land near Jamestown in February and March. On this property a 200-ft. tunnel is being driven to tap the shaft for drainage and second exit. Estimated that Tuolumne County will produce 7000 to 10,000 tons of chrome ore in 1918.

COLORADO

Boulder County

WASATCH (Boulder)—Mill operating steadily. Company working Mendota, Frostberg and other properties. Developing through Ashby, Victoria and Diamond tunnels.

Clear Creek County

DENBY MINES CO. (Silver Plume)—Operating Terrible mine. Making regular shipments of good-grade silver-lead ore. Main production from 11th to 14th level. Large shoot opened recently on 14th level. Production limited by men available.

GEM (Idaho Springs)—Rich strike made recently by Little Four Leasing Co. in driving east from Argo tunnel. Wide shoot of ore assaying $40 gold opened. In this shoot is a narrow streak of sylvanite, assays from which gave 100 oz. gold per ton.

SMUGGLER (Georgetown)—Making regular shipments of lead-zinc milling ore, and some copper-silver shipping-grade ore. Considerable development work in ore under way. Winze 550 ft. west of shaft being sunk in ore. Mine owned by Hollingsworth Mining Company.

Dolores County

RICO PRODUCTION for February was 51 cars.

RICO ARGENTINE (Rico)—Shipments in 1917 returned from smeltery $88,837. Company and lessees produced equal tonnages. Entire indebtedness of company expected to be written off in 1918.

Gilpin County

EVERGREEN (Central City)—Mine and mill operating steadily. Electric pump installed, and lowest level drained. Large shoot milling-grade ore opened here. Flotation process, recently installed in mill, has brought saving up to 95%. Chief metal in ore is copper.

Lake County

BOHN (Leadville)—Regular shipments assaying 30 to 38% manganese being made. Blanket deposit on 465 level opened for width of 30 ft.

NISI PRIUS (Leadville)—Lessees have secured extension of time on this Iowa Gulch mine, and development work to open new shoots manganese ore will be undertaken.

Mineral County

CHAMPION (Creede)—Operations on this silver mine on Mount Champion to be resumed. Owns three patented claims, and mine opened by adits. Recent cyanide experiments satisfactory.

Ouray County

GEM & FLOAT (Ouray)—High-grade copper-silver ore being opened in these mines on north side of Uncompahgre River, low down in sedimentary series.

HUDSON (Ouray)—This property, in Red Mountain district, will be reopened by lessees. Mine formerly a large producer of copper-silver ore from "pipes" or "chimneys." Dumps also contain considerable milling-grade ore.

MOUNTAIN TOP (Ouray)—Regular production crude ore and concentrates being made. Development work continues to open both shipping and milling-grade ores.

TELLER (Ouray)—Reopened by lessees. Good-grade lead-silver ore being broken for shipment.

WANAKAH (Ouray)—Regular shipments heavy pyrite ore assaying in gold and silver being made to Ohio and Colorado smelting plant at Salida.

San Juan County

ALEXANDRIA (Silverton)—Property secured under lease by the King Brothers. Upper tunnel cleaned out and several pockets of sulphide ore opened. Three carloads shipped from development.

MAMMOTH TUNNEL (Silverton)—Stated tunnel project may be resumed. Started several years ago, and was driven 2000 ft. into Red Mountain. Cuts Henrietta vein at depth of 2000 ft., and will cut other large veins at greater depth. Portal near railroad and power line, and safe from snow slides.

San Miguel County

TELLURIDE CONCENTRATE SHIPMENTS for March were: Liberty Bell, 24 cars; Smuggler-Union and Black Bear, 34 cars to Pueblo and 50 cars to Durango; Tomboy, 54 cars; total, 162 cars, largest shipments from district in normal times. In March, 1917, shipments totaled 121 cars.

TOMBOY (Telluride)—Mill running full time on ore from Montana and other workings, some of which extend into Ouray County. Regular shipments of concentrates made.

Summit County

AMERICAN METAL CO. (Buffehrs)—First shipment, 25 tons high-grade molybdenum concentrates, made recently from new 250-ton concentration plant.

BLACK METAL GROUP (Kokomo) — Tests on 500-ton lot molybdenum ore at Pingree mill, Leadville, were entire success. Property will be reopened this spring. Ore in blanket vein, quartz gangue between limestone and quartzite.

BRECKENRIDGE DISTRICT has five dredges belonging to three companies now in operation.

FRENCH GULCH DREDGING CO. (Breckenridge) — Dredge completely overhauled, and operations begun. Ground to be worked this season lies between Wellington mine and old town of Lincoln. W. F. Sears in charge.

MICHIGAN MINING (Kokomo)—Operating steadily. This summer work will be done through 2220-ft. Uthoff tunnel, and output will be greatly increased.

MOLLY B (Breckenridge)—Compressor building and blacksmith shop finished, and all machinery on ground. Prospecting flat vein to be done by drilling. Three headings will also be driven. Recently Fox Lake, Como, and Breckenridge lode claims acquired by company.

MOLYBDENUM PRODUCTS CO. (Buffehrs)—Mill will be in operation in short time; capacity, 250 tons daily.

POWDER RIVER DREDGE (Breckenridge)—Transformer house burned on morning of Mar. 21, due to some defect in electric installation. Dredge was all ready to begin operations, and this accident will cause serious delay. New transformer house being built at once.

READY CASH (Frawley)—Operating old Progress mill on own and custom ores. Lead, zinc and iron sulphide ores purchased.

ROBINSON TUNNEL (Frawley)—Regular shipments made by lessee, Charles W. Walker.

WELLINGTON (Breckenridge) — Pump capacity will be increased to handle increased flow of water from sixth level.

Teller County

CRESSON (Cripple Creek)—Diamond drilling on 8th level struck good-grade ore. Drifting to this ore is under way. Ore also opened on 4th, 9th and 10th levels.

DANTE (Cripple Creek)—High-grade ore recently opened on 600 level by sub-lessees from Big Toad Gold Mining and Milling Company.

EAGLE ORE (Cripple Creek)—Stockholders' meeting called Apr. 13 for election of board of directors.

FREE COINAGE CONSOLIDATED (Cripple Creek)—Good oreshoot opened on 450 level of Pinto mine, on Bull Hill. Shipments have begun.

VINDICATOR (Cripple Creek)—Difficulties of operating flotation plant being gradually overcome; good saving now being made. George A. Stahl recently elected general manager to succeed Irving T. Snyder.

W. P. H. LEASE (Cripple Creek)—Shipping ore from 900 level. Owned by United Gold Mines Company.

IDAHO

Shoshone County

AJAX (Burke)—Drift from Moonlight shaft developed two feet of lead-silver ore. Another drift being driven 600 ft. below from Oom Paul crosscut. Ore distributed across face and steadily improving. Property joins Hercules on the east, having common end line and presumed to have same vein. Face of drift from Moonlight shaft not more than 300 ft. from Hercules line. Ajax controlled by New England interests.

AMBERGRIS (Burke)—Two feet of shipping ore and four feet milling ore reported north of and adjoining Hercules. Strike made in crosscut from No. 4 adit level of Hercules. Shaft 200 ft. deep, sunk many years ago, shows two feet of good ore. Present ore east of shaft and estimated 1000 ft. below. Company controlled by the Days.

KANSAS

Joplin District

PHILLIPS (Baxter)—Will erect 400-ton mill on lease southeast of Treece. Hope to have plant complete in 90 days.

PLAYTER BROS. (Joplin)—Have sold for $150,000 a lease developed by them near Treece, Kan., to Hubert Boien and associates, of Oklahoma City. Lease was drilled last summer, and shaft put down in autumn and winter. Recent developments have shown rich body of ore, and lease was sold for price mentioned without more than ordinary shaft equipment.

MICHIGAN

Copper

CALUMET AND HECLA (Calumet)—Production of copper for the month of March was: Ahmeek, 2,699,121 lb.; Allouez, 711,925; C. & H., 6,894,578; Centennial, 210,757; Isle Royale, 1,266,088; La Salle, 178,528; Osceola, 1,443,980; Superior, 163,572; White Pine, 216 020 pounds.

FEDERAL SYNDICATE (Calumet)—Stopped first hole at depth of 536 ft. Passed through sandstone and conglomerate after showing of green carbonate of copper. New hole located 750 ft. west and 210 ft. north of first on an outcrop of trap rock.

MASS (Mass City)—Output dropped to about 900 tons.

MAYFLOWER-OLD COLONY (Houghton)—Shaft down 340 ft.; skip in operation. First copper to be derived from 1500 ft. level, and best nearly 2000 level. Mayflower lode, as foreshadowed by many holes, though considerably faulted, should be good.

NORTH LAKE (Lake Mine)—New lode in southeast drift 3rd level indicated a few years ago by No. 13 diamond drill hole, has width of 20 ft., with two to three feet near hanging wall high grade and 10 ft. more having fine copper, with enough small mass to average well. Showing good in both drifts, which are seven feet wide.

SENECA (Calumet)—Vertical shaft down 220 ft. in usual trap rock of district. Ventilation installed in mine.

SOUTH LAKE (Lake Mine)—March tonnage, 1600; assays 33 lb. copper per ton, of which 25 lb. is disseminated and 8 lb. is mass.

WINONA (Winona)—Two postponements of annual meeting to allow naming of director by minority, who desire to sink King Philip shaft No. 2. Bonus paid the men for March indicates yield of 16 lb. of copper per ton.

MISSOURI

Joplin District

BUTTE-KANSAS (Waco)—New mill, replacing mill burned on Christmas, completed and placed in operation. Development has been progressing through field shaft.

LITTLE MARTHA (Joplin)—Rebuilt hopper, derrick and walking-beam pump destroyed by fire, and is resuming operations.

MONTANA

Jefferson County

AMALGAMATED SILVER MINES CO. (Clancy)—Shaft completed to 250 ft. and crosscut driven.

MOUNTAIN STATES MINES (Alhambra)—Machinery all in place, and work to start unwatering shaft 200 ft.

MOUNT WASHINGTON MINE (Wickes)—Tunnel 3600 ft. long and 800 ft. below surface. Galena Smeltery accepts only 30 tons per day from output of mine.

Lewis and Clark County

BARNES-KING CO. (Marysville)—New pump placed at 650 level of Shannon mine.

BELL BOY (Marysville)—Strike of gold-silver-lead ore lately made is considered good. Ore 5 ft. wide.

GRASS VALLEY MINING DISTRICT properties operated by Helena Mining Bureau and by Cruse Consolidated company west of Fort Harrison near Helena, have been closed down by strike of hoisting engineers, who quit work when refused demand that their wages be increased from $4.50 to $5.50 a day.

Silverbow County

ANACONDA (Butte)—Slight fire on 900 level of Rarus mine, started by carbide lamp. Smoke caused closing of Berkeley mine on night of Apr. 6. Fire quickly extinguished, and operations in Berkeley resumed on following day. January report of accidents in company's mines shows a total of 39, or 1.22% per 10,000 shifts. High-grade copper vein cut in crosscut from Belmont to Davis Daly mines on 2500 ft. level.

NEVADA

Nye County

TONOPAH ORE PRODUCTION for the week ended Apr. 6 amounted to a total of 8918 tons of estimated gross milling value $151,606. The producers were: Tonopah Belmont, 1040 tons; Tonopah Mining, 3150; Tonopah Extension, 2428; Jim Butler, 498; West End, 1059; MacNamara, 536; Montana, 103; Cash Boy, 50, and miscellaneous, 54 tons.

KANSAS CITY-NEVADA CONSOLIDATED MINES CO. (Bruner)—Company to install the mill and pipe the water over Ione Valley, a distance of nine miles, immediately. The mill will have a 50-ton capacity to start, and will be built on the unit plan. H. E. Swain is the company engineer, and is at present in Denver selecting the mill equipment.

UNION AMALGAMATED (Manhattan)—Milling company ore at rate of 50 tons per day from 350 and 600 levels. Drifting on 350 level to develop Swanson orebody. Trouble experienced lately with hoisting engine.

WHITE CAPS (Manhattan)—West 500 crosscut advanced 465 ft.; 40 ft. in limestone. Flattening of dip increases distance to orebody, but general indications favorable. Raise 504 up 103 ft. in good-grade ore. Flow of water west 500 level workings almost ceased. Output tonnage for week normal, and grade of ore materially increased.

White Pine County

CONSOLIDATED COPPERMINES CO. (Kimberly)—Started second 500-ton section of mill recently. Giroux shaft unwatered with bailers to 1200 level; pumps removed, overhauled, and have now begun pumping; the water is used for milling operations.

OKLAHOMA

Joplin District

NEIL (Lincolnville)—Preparing to build mill at Old Abe site. District development has drained mine to the extent of necessitating shaft sinking for mill water.

RED ROSE (Quapaw)—Building new mill on Horseshoe land. W. D. Adkins, Holdenville, is president.

TRUE BLUE (Quapaw)—Building 250-ton mill west of Quapaw.

SOUTH DAKOTA

Lawrence County

CUTTING (Deadwood)—Two drifts extended to tap ore. One of these advanced over 200 ft. and should reach ore soon. Installation of compressor and machine drills is under consideration.

GOLDEN REWARD (Deadwood)—Company has suspended operations. Experimenting with the "blue ores" to be continued in the hope that a satisfactory method of treatment will be devised. Property has had 35 years' continued bullion production. Advanced cost of operations and low grade of ore are given as reasons for the cessation of work.

ORO HONDO (Deadwood)—Announcement made that development work will not be resumed until after the war.

Pennington County

INGERSOLL (Keystone)—Mine leased to A. T. Roos and associates, of Deadwood, who will ship lithia ores.

UTAH

Juab County

EAGLE & BLUE (Eureka)—Drifting to be started on 2000 level, deepest level of mine. Expected to find at 150 to 200 ft. from station continuation of orebody followed to 1875 ft., and productive of large tonnage. Shipments of 20 cars weekly being made.

EUREKA LILY (Eureka)—Drifting being done on 1400 level, to east following east-west fissure in hope of finding continuation of Tintic Standard ores. R. L. Edwards is manager.

EUREKA BULLION (Eureka)—Shaft down 750 feet. Possible sinking may be discontinued at 800-ft. point, and drifting started. John Bestelmeyer is superintendent.

GRAND CENTRAL (Mammoth)—During three weeks ended March 23, there were shipped 38 cars or about 1900 tons of shipping ore. February shipments, 67 cars, and January, 45.

TINTIC DRAIN TUNNEL (Eureka)—This new undertaking of Knight interests, although hampered by delay in delivery of equipment, is making progress working by hand. Transformers lost en route located, and expected on ground soon, when, after connecting with Utah Power Co. lines, work will be done with machine drills. At present two shifts working, force consisting of 20 men.

TINTIC MILLING (Silver City)—During February, mill received 5000 tons of siliceous ores for treatment, mostly from Knight properties.

TINTIC STANDARD (Eureka)—Motor trucks running smoothly over road from mine to loading station, and shipping about 100 tons per day.

VICTORIA (Eureka)—Property adjoining and controlled by Eagle & Blue Bell, shipping a car of ore per day.

Salt Lake County

CARDIFF (Salt Lake)—This Big Cottonwood property opening successfully recent strike, regarded by management as downward extension of old orebody. At present about 3000 tons accumulated ore at bins at mouth of South Fork of Big Cottonwood awaiting shipment. Ore at depth reported to be of good grade.

Summit County

PARK CITY SHIPMENTS in March were 8427 tons. Largest shipper, Ontario with 2469 tons; following Silver King Coalition, Judge, Silver King Consolidated, Daly West, Iowa Copper, and West Quincy.

SILVER KING CONSOLIDATED (Park City)—Mill producing one car of concentrates weekly. Recent shipment of 50 tons stated to have brought about $4500, or $90.88 per ton.

CANADA

British Columbia

NEW HAZELTON GOLD COBALT CO. (Vancouver)—Three tons of molybdenum ore shipped.

Ontario

COBALT SHIPMENTS IN MARCH, 38 cars or 1442 tons shipping ore, and in addition 898,668 oz. of silver bullion. Production for the month from all the mines was approximately 1,500,000 oz. of silver.

BRITISH AMERICA NICKEL (Nickelton)—To construct refinery at Deschenes, near Hull, Que., where a site has been purchased and construction to begin immediately. Good progress being made with the construction of the smeltery at the Murray mine, in the Sudbury district, at which about 650 men are now employed.

BUFFALO (Cobalt)—Taking in supplies to the new district of Dougherty south of Temagami, on the T. & N. O. Ry., where prospecting for silver to be carried on. The La Rose and the Penn Canadian also making arrangements to prospect their claims in that section.

HILL GOLD (Beatty Township)—Shaft down 125 ft., and a Hardinge mill grinding plant is nearing completion.

INTERNATIONAL NICKEL CO. OF CANADA (Port Colborne)—The capital stock increased from $5,000,000 to $50,000,000.

KIRKLAND LAKE (Kirkland Lake)—Installation of mill delayed by transportation difficulties.

KIRKLAND PORPHYRY (Kirkland Lake)—Reported to have found good ore in shaft sinking below the 300 level.

LA ROSE CONSOLIDATED (Cobalt)—High-grade ore hoisted from the 410 level of Violet. The vein, however, continues patchy and variable.

McINTYRE (Porcupine)—Investigating properties in British Columbia.

NIPISSING (Cobalt)—In March company produced silver valued at $308,048 and shipped bullion valued at $475,013.

THACKERAY (Bourkes Station)—Company acquired seven claims near the Murray-Mogridge.

THOMPSON-KRIST (Porcupine)—Drift from 400 level of Vipond within 20 ft. of Thompson-Krist ground and has a 2-ft. vein of milling grade. Drift to be continued several hundred feet into Thompson-Krist.

TRETHEWEY (Cobalt)—Machinery for new flotation mill beginning to arrive. Plant to have capacity of 150 tons of old tailings per day.

SOUTH AMERICA

Peru

CERRO DE PASCO (Cerro de Pasco)—Production in March, 6,966,000 lb. blister copper.

BELGIAN CONGO

UNION MINIERE DU HAUT KATANGA (Katanga)—Copper productions in March 3,086,440 pounds.

The Market Report

SILVER AND STERLING EXCHANGE

Apr.	Sterling Exchange	Silver New York, Cents	Silver London, Pence	Apr.	Sterling Exchange	Silver New York, Cents	Silver London, Pence
18	4.7550	95⅛	47¼	22	4.7550	99¼	49
19	4.7550	96⅛	47⅛	23	4.7550	99¼	49
20	4.7550	97⅛	48⅛	24	4.7550	99¼	49¼

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine.

DAILY PRICES OF METALS IN NEW YORK

Apr.	Copper Electrolytic	Tin Spot.	Lead N. Y.	Lead St. L.	Zinc St. L.
18	*23½	†	6.67½ @6.72½	6.60 @6.65	6.60 @6 65
19	*23½	†	6.65 @6.70	6.60 @6 65	6.57½ @6 62½
20	*23½	†	6.65 @6.70	6.55 @6.60	6.57½ @6 62½
22	*23½	†	6.65 @6.70	6.55 @5 60	6 55 @6.60
23	*23½	†	6.65 @6.70	6.55 @6.60	6 55 @6 60
24	*23½	†	6.60 @6.65	6.55 @6 60	6.55 @ 6.60

*Price fixed by agreement between American copper producers and the U. S. Government, according to official statement for publication on Friday, September 21, 1917.

†No market.

The above quotations (except as to copper, the price for which has been fixed by agreement between American copper producers and the U. S. Government, wherein there is no free market) are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for the deliveries constituting the major markets, reduced to basis of New York, cash, except where St. Louis is the normal basing point.

The quotations for electrolytic copper are for cakes, ingots and wirebars.

We quote electrolytic cathodes at 0.05 to 0.10c. below the price of wirebars, cakes and ingots.

Quotations for spelter are for ordinary Prime Western brands. We quote New York price at 17.5c. per 100 lb. above St. Louis.

Some current freight rates on metals per 100 lb. are: St. Louis-New York 17c.; St. Louis-Chicago, 13c.; St. Louis-Pittsburgh, 13.1 cents.

LONDON

Apr.	Copper Standard Spot	Copper Standard 3 Mos.	Copper Electrolytic	Tin Spot	Tin 3 Mos.	Lead Spot	Zinc Spot
18	110	110	125	330	330	29½	54
19	110	110	125	330	330	29½	54
20	...	...	...	...	...	...	...
22	110	110	125	333	333	29½	54
23	110	110	125	343	343	29½	54
24	110	110	125	343	343	29½	54

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2,240 lb. For convenience in comparison of London prices, in pounds sterling per 2,240 lb., with American prices in cents per pound the following approximate ratios are given, reckoning exchange at $4.7515. £29½ = 6.2576c.; £54 = 11.4545c.; £110 = 23.3333c.; £125 = 26.5151c.; £260 = 55.1513c.; £280 = 59.3937c.; £300 = 63.6362c. Variations, £1 = 0.2121205c.

Metal Markets

NEW YORK—Apr. 24, 1918

Further weakness in both lead and zinc and more acuteness in the situation in tin were the chief features of the metal market this week.

Copper—There was a rather large increase in the mine production in March, but the refiners are able as yet to increase their production but slightly, the unsatisfactory labor situation being a great handicap to them. The European demand for copper, which lulled a little while back, has now become very large, and refiners are hard pressed to supply both this and the domestic requirements. They are unable to supply industrial consumers with all that they need, and domestic industry is still on a ration basis. The present agreement between the producers and the Government expires with the end of May. There is a large inquiry for copper for delivery in June and later, which refiners are booking subject to whatever price may be agreed upon between them and the Government following May 31.

Copper Sheets are quoted at 31½c. per lb. for hot rolled, and 1c. higher for cold rolled. Copper wire is quoted at 26½c. f.o.b. mill, carload lots.

Tin—The situation is becoming more and more acute. Chinese tin to arrive at the Pacific Coast is held at 91c., while 89c. is being paid for April-May shipments. Some houses received cable advices today that the Dutch government has prohibited shipments of tin from Batavia. There is possibly some connection between this and the sharp rise in London yesterday.

Lead—There was a considerable increase in the volume of business, transactions comprising several lots of large size. This business was done, however, at declining prices, and buyers seemed to need some coaxing. A large quantity of lead was sold today at 6½c., New York, with more offered at the same price.

The strike at the smelting works of the St. Joseph Lead Co. was settled on Apr 22 on the reasonable terms that the company had offered all along.

The litigation over ore-smelting contract between the American Smelting and Refining Co. and the Bunker Hill & Sullivan has been compromised.

Zinc—A larger amount of business was reported than in the previous week, but it was taken at declining prices. There was considerable inquiry from galvanizers, and some considerable sales to them. It was regarded as encouraging that the present prices interested them, although it would not seem that it requires much nerve to buy spelter at the present level.

Zinc Sheets—Unchanged at $15 per 100 lb., less usual trade discounts.

Other Metals

Aluminum—The price quoted is the Government price of 32c. per lb. but the market is unsettled and there are few transactions.

Antimony—Unchanged at 12½c. for spot, with only a small business done. None of the importers quoted on futures. The statistical position in this market is steadily improving. One well-informed house estimates that the present consumption is at the rate of 1500 tons per month, while the importation is only 800 tons.

Bismuth—Metal of the highest purity for pharmaceutical use is quoted at $3.50 per lb. for wholesale lots—500 lb. and over.

Cadmium—This metal is quoted at $1.40 per pound.

Quicksilver—A fair volume of business was reported at $102 for California virgin. Mexican virgin was quoted nominally at $118. San Francisco reports, by telegraph, $115, steady.

Gold, Silver and Platinum

Silver—Silver has rapidly advanced this week in London. This advance has offset the premium on New York over the official price. The notable feature of the week has been the passage of the Silver bill authorizing the Government to pay $1 per oz. for silver 1000 fine.

Mexican Dollars at New York: Apr. 18, 77; Apr. 19, 77; Apr. 20, 77; Apr. 22, 77; Apr. 23, 77; Apr. 24, 77.

Platinum—Refined ingot unchanged at $108.

Palladium—Strong at $150. Supply very low.

Iridium—Quoted at $150, but probably difficult to get, supply being very small.

Zinc and Lead Ore Markets

Joplin, Mo., Apr. 20—Blende, per ton, high, $56.90; basis 60% Zn, premium $55@50; medium to low, $42.50@37.50; average basis, $46.25; calamine, per ton, 40% Zn, $30@25. Average selling prices: Blende, $47.23; calamine, $29.93; all ores, $46.72 per ton.

Lead, high $86.10; basis 80% Pb, $85@80; average selling price, all grades of lead, $84.56 per ton.

Shipments the week: Blende, 12,245; calamine, 371; lead, 1630 tons. Value all ores the week, $727,380.

Present prices, with little prospect of advances, seem not to dishearten the producers in the Oklahoma field. The larger mines continue outputting heavily, and new ones are weekly being brought into the producing list. The output of this new territory is now nearly double that of the entire district four years ago. Oklahoma is producing two-thirds the zinc and three-fifths the lead output of the district.

Platteville, Wis., Apr. 20—(By telegraph) Blende, basis 60% Zn, $50 base for premium grade down to $44 base for second-grade. Lead ore, basis 80% lead, $82 per ton. Shipments reported for the week are 2176 tons blende, 378 tons galena and 2329 tons sulphur ore. For the year the totals are 38 717 tons blende, 2247 tons galena and 15 091 tons sulphur ore. During the week 3050 tons of blende were shipped to separating plants.

Other Ores

Antimony Ore—Offered at $1.75 per unit, with but little inquiry for it.

Chrome Ore—Charles Hardy reports that a contract for ore running 45% chromic oxide was closed for five months at $1.50 per unit, f.o.b. shipping point. He says, furthermore, that considerable material is now being offered and that the outlook is much more promising that it has been for the last three months.

Iron Ore—The Lake shipping movement will open gradually. It is to proceed according to railroad facilities at the lower end of the Lakes, and the railroads still have all the work they can do taking Lake Erie dock ore. Prices remain on the basis of $5 05 for Mesabi nonbessemer, at Lake Erie dock. The vessel rate has been set at $1 from the head of the Lakes, for season or wild charters, the contract rate last year having been $1, with some wild tonnage at higher prices occasionally.

Manganese Ore—This is in great demand. We quote $1.20@1.30.

Molybdenum Ore—Buyers are conspicuous by their absence. One the other hand, there does not seem to be any pressure to sell.

Pyrites—Spanish lump is quotable to those who possess a license from the Government at 17c. per unit on the basis of 9s. ocean freight, buyer to pay war risk, less 2% and excess freight. It is said that 20c. per unit is being paid at the mine for domestic pyrite.

Tungsten Ore—The market was again active. Business in scheelite was done at $24 50, and in wolframite at $19@24, according to grade.

Iron Trade Review

PITTSBURGH—Apr. 23

Production of pig iron and steel has not gained appreciably over the rate attained early in March, and may be said in general to be at the rate of about 85% of capacity, the tonnage fully equalling the output during the major part of 1916, when operations were full, with a capacity 15 to 20% below that now existing. The chief restrictive influence to full production continues to be the poor movement of Connellsville coke. Despite well-sounding reports and predictions, the car supplies in the Connellsville region have not been aver-

aging better since Apr. 1 than they did in March. Few blast furnaces are now actually banked, but many are running gaited, their coke supplies being carefully husbanded, while a number of furnaces out of blast cannot get in. The Carnegie Steel Co. has 10 of its 59 stacks out and would blow most of these in if it had the coke. The Republic Co., has been trying for three weeks to secure a coke supply to blow in an idle stack, and has not got the furnace in yet. In one sense, the scrap supply has restricted steel output, but most steel mills take the view that it is not that the scrap supply is much below normal, but rather that they have not been able to secure the extra scrap that would make up for the deficiency in pig iron. Scrap offerings, however, are increasing partly through the increased rate of shell production and partly because holders are forced to sell because, while waiting for better terms, the material has accumulated.

The steel trade has lately begun to take a larger view of Government steel requirements, and evidently has been given convincing arguments by Washington that the plans there will consume more steel than the producers had estimated. This is especially the case with shipbuilding, which must be proceeding at a more rapid rate than recent reports of vessel completions and vessel launchings would indicate. Only recently the steel producers were fearful that there would not be enough demand, war and commercial, to engage the capacity indefinitely, but now the Railroad Administration has decided to order bessemer rails instead of openhearth, and appears ready to change designs for the 100 000 freight cars so as to use wood superstructures. Undoubtedly these decisions must be based upon accurate information. Many press dispatches from Washington are misleading, and do not reflect the information actually in possession of official Washington.

Transactions covering products for ordinary commercial material continue light. There appears to be an insistent demand for certain products, but only for early deliveries and representing no large tonnage. Government orders continue to be placed at about the same rate as formerly, and new requirements are in evidence right along. Most of the estimates as to shell-steel tonnages that will be required are, however, exaggerated. New Government requirements in steel run largely to steel for our Allies, and these shipments promise to be heavier during the remainder of the year than any of the previous records.

Pig Iron—Merchant furnaces are producing at not far from capacity and are fairly well supplied with cars for shipping iron, so that little is in stock, but many consumers are eager for heavier shipments. Sales are confined to iron required for Government orders and small lots for early delivery for commercial purposes. The market remains at the Government limits: Bessemer, $35.20; basic, $32; No. 2 foundry, $33; malleable, $33.50; forge, $32, f.o.b. furnace, freight from Valleys to Pittsburgh being 95 cents.

Steel—More shell-discard steel is being offered, while there is also a broader demand, more consumers having brought themselves to use this class of steel. Ordinary soft steel is rarely offered. Prices for soft steel remain at Government limits: Billets, $47.50; small billets, $51; sheet bars, $51; slabs, $50; rods, $57.

Ferroalloys

Ferromanganese—There is a moderate demand, and prices are well held, at $250, delivered, for 70% ferromanganese, and $70, f.o.b. furnace, for spiegeleisen, 16 to 18 per cent.

Coke

Connellsville Coke—Recent reports of better car supplies have not been borne out by actual shipments. Occasionally the railroads have an inordinate supply for a day or two, as operators are unable to load the suddenly increased number, and the extra cars hold over. Averaging a week at a time, the supplies remain poor. Shipments the last three weeks have averaged only about 325,000 tons a week, which is a trifle below the March average, while requirements are probably fully 375,000 tons. Offerings in the open market are rare, contract shipments taking up all the coke that can be moved, with occasional exceptions. The market remains at the Government limits: Furnace, $6; 72-hour selected foundry, $7; crushed, over 1-in., $7.30, per net ton at ovens.

BUY A LIBERTY BOND

STOCK QUOTATIONS

N. Y. EXCH.†	Apr. 23
Alaska Gold M.	1⅛
Alaska Juneau	1⅛
Am. Sm. & Ref., com.	77
Am. Sm. & Ref., pf.	104⅛
Am. Sm. Sec., pf., A	88⅛
Am. Zinc	14
Am. Zinc, pf.	45
Anaconda	63⅛
Batopilas Min.	1
Bethlehem Steel	80⅛
Bethlehem Steel, pf.	88⅛
Butte & Superior	21⅛
Butte Cop. & Zinc	9
Cerro de Pasco	32
Chile Cop.	16⅛
Chino	42⅛
Colo. Fuel & Iron	40⅛
Crucible Steel	65⅛
Crucible Steel, pf.	89
Dome Mines	8
Federal M. & S.	9⅛
Federal M. & S., pf.	32
Great Nor., ore ctf.	29⅛
Greene Cananea	43
Gulf States Steel	100
Homestake	75
Inspiration Con.	52⅛
International Nickel	28
Kennecott	32⅛
Lackawanna Steel	79⅛
Mexican Petrol.	94
Miami Copper	28⅛
Nat'l Lead, com.	57⅛
National Lead, pf.	105
Nev. Consol.	19⅛
Ontario Min.	10
Ray Con.	25
Republic I. & S., com.	81
Republic I. & S., pf.	97⅛
Sloss-Sheffield	60
Tennessee C. & C.	17
U. S. Steel, com.	94⅛
U. S. Steel, pf.	110⅛
Utah Copper	80
Va. Iron C. & C.	67

N. Y. CURB†	Apr. 23
Big Ledge	⅛
Butte & N. Y.	‡⅛
Butte Detroit	⅛
Caledonia	.45
Calumet & Jerome	1⅛
Can. Cop. Corpn.	1⅛
Carlisle	‡2
Cashboy	.00⅛
Con. Ariz. Sm.	1⅛
Con. Coppermines	5⅛
Con. Nev.-Utah	‡⅛
Emma Con.	.21⅛
First Nat. Cop.	‡1⅛
Goldfield Con.	.28⅛
Goldfield Merger	.03⅛
Greenmonster	⅛
Hecla Min.	4⅛
Howe Sound	‡4⅛
Jerome Verde	⅛
Kerr Lake	5⅛
Louisiana	‡.50
Magma	38
Majestic	24
Marsh	‡.06
McKinley-Dar-Sa.	.40
Milford	‡1⅛
Mohican	‡.25
Mother Lode	.44
N. Y. & Bond	‡12⅛
Nipissing Mines	8⅛
Nixon Nevada	⅛
Ohio Cop.	⅛
Rawley	‡2⅛
Ray Hercules	4⅛
Richmond	‡.56
Rochester Mines	.38
St. Joseph Lead	15
Standard S. L.	‡⅛
Stewart	.20
Success	.08⅛
Tonopah	‡2⅛
Tonopah Ex.	1⅛
Trethillion	‡.31⅛
Troy Arizona	‡.18
United Cop.	‡⅛
United Verde Ext.	38⅛
United Zinc	1⅛
Utica Mines	‡.08

SAN FRAN.*	Apr. 23
Alta	.03
Andes	.17
Best & Belcher	.03
Caledonia	.05
Challenge Con.	.02
Confidence	.04
Con. Virginia	.41
Gould & Curry	‡.01
Hale & Norcross	.02
Jacket-Cr. Pt.	.06
Mexican	.18
Occidental	‡.60
Ophir	.17
Overman	.01
Savage	.04
Sierra Nevada	.10
Union Con.	.89
Utah Con.	.02
Belmont	3.17
Jim Butler	.66
MacNamara	.11
Midway	.06
Mont.-Tonopah	.12
North Star	.04
Rescue Eula	.08
West End Con.	‡.77
Atlanta	.09
Booth	.05
Comb. Frac.	‡.02
Field Daisy	‡.02
Florence	.12
Jumbo Extension	.10
Kewanas	.04
Nevada Hills	.04
Nevada Packard	.22
Round Mountain	.30
Silver Pick	.04
White Caps	.39
Big Jim	‡.75
United Eastern	4.00

BOSTON EXCH.*	Apr. 23
Adventure	.1
Ahmeek	78⅛
Algomah	.25
Allouez	50⅛
Ariz. Com., ctfs.	13
Arnold	.20
Bonanza	.18
Butte-Balaklava	.25
Calumet & Ariz.	69
Calumet & Hecla	433
Centennial	13⅛
Copper Range	45⅛
Daly West	1⅛
Davis-Daly	5⅛
East Butte	9
Franklin	4⅛
Granby	76
Hancock	7⅛
Hedley	12
Helvetia	.15
Indiana	‡.50
Isle Royale	23
Keweenaw	1⅛
Lake	5⅛
La Salle	2⅛
Mason Valley	4⅛
Mass	5⅛
Mayflower	1⅛
Michigan	2⅛
Mohawk	62
New Arcadian	1⅛
New Idria	15
North Butte	14
North Lake	.50
Oilway	.75
Old Dominion	39⅛
Osceola	54
Quincy	71
St. Mary's M. L.	49
Santa Fe	.90
Seneca	9⅛
Shannon	4⅛
Shattuck-Ariz.	16
So. Lake	1⅛
So. Utah	.12
Superior	4⅛
Superior & Bost.	2⅛
Trinity	3⅛
Tuolumne	.99
U. S. Smelting	38
U. S. Smelt'g, pf.	43
Utah Apex	2
Utah Con.	9⅛
Utah Metal	2⅛
Victoria	2⅛
Winona	1⅛
Wolverine	28
Wyandot	.70

BOSTON CURB*	Apr. 23
Alaska Mines Corp.	.15
Bingham Mines	‡9⅛
Boston Ely	.90
Boston & Mont.	.52
Butte & Lon'n Dev.	.20
Calaveras	1⅛
Calumet-Corbin	‡.01
Chief Con.	2
Cortez	.05
Crown Reserve	.20
Crystal Cop.	.31
Eagle & Blue Bell	2
Gila Copper	‡17
Houghton Copper	.75
Intermountain	.05
Iron Cap, Com.	18
Mexican Metals	.40
Mines of America	1⅛
Mojave Tungsten	.07
Nat. Zinc & Lead	.20
Nevada-Douglas	.75
New Baltic	.90
New Cornelia	16
Oneco	.20
Pacific Mines	‡.35
Rex Cons.	.11
Yukon Gold	1

SALT LAKE*	Apr. 23
Bannack	‡.26
Cardiff	3.25
Colorado Mining	.07
Daly	1.47⅛
Empire Copper	‡1.00
Gold Chain	.06
Grand Central	.40
Iron Blossom	.35
Judge	5.50
Lower Mammoth	‡.03
May Day	‡.01⅛
Moscow	‡.02
Prince Con.	.54
Rio Wellington	.14⅛
Silver-King Coal'n	1.67⅛
Silver King Con.	2.02
Sioux Con.	.03⅛
So. Hecla	.65
Tintic Standard	‡1.30
Uncle Sam	.00⅛
Walker Cop.	1.67⅛
Wilbert	.10⅛
Yankee	‡.02

TORONTO*	Apr. 23
Adanac	.09⅛
Bailey	.03
Beaver Con.	.26⅛
Chambers Ferland	‡.09
Coniagas	3.05
Hargraves	.07⅛
La Rose	.53
Peterson Lake	.09⅛
Temiskaming	.28
Wettlaufer-Lor.	.04⅛
Davidson	.33
Dome Exten.	.11⅛
Dome Lake	.20
Hollinger	5.15
McIntyre	1.32
Newray	.18⅛
Porcu. Crown	.14
Teck-Hughes	.49
Vipond	.18
West Dome	.13

STOCK QUOTATIONS—Continued

COLO. SPRINGS	Apr. 23
Cresson Con.	4.75
Doctor Jack Pot.	.03⅛
Elkton Con.	.04⅛
El Paso	.10
Gold Sovereign	‡.02
Golden Cycle	1.74
Granite	.33
Isabella	.05
Mary McKinney	.05⅛
Portland	.94
United Gold M.	.15
Vindicator	.25

LONDON	Apr. 8
Burma Corp.	£1 5s 0d
Cam & Motor	0 11 0
Camp Bird	0 8 3
El Oro	0 9 0
Esperanza	0 9 0
Mexican Mines	5 5 0
Min. Corp. Can.	0 16 6
Nechi, pfd.	0 10 6
Oroville	0 18 6
St. John del Rey	0 16 9
Santa Gert'dis.	0 13 0
Tomboy	0 17 6

* Bid prices. † Closing prices. ‡ Last Quotations.

MONTHLY AVERAGE PRICES OF METALS

Silver	New York			London		
	1916	1917	1918	1916	1917	1918
Jan.	56.775	75.630	88.702	26.960	36.682	44.356
Feb.	56.755	77.585	85.716	26.975	37.742	42.792
Mar.	57.975	73.861	88.082	27.597	36.410	43.620
April	64.415	73.875	.....	30.662	36.963	.....
May	74.269	74.745	.....	35.477	37.940	.....
June	65.024	76.971	.....	31.060	39.065	.....
July	62.940	79.010	.....	30.000	40.110	.....
Aug.	66.083	85.407	.....	31.498	43.418	.....
Sept.	68.515	100.740	.....	32.584	50.920	.....
Oct.	67.855	87.332	.....	32.361	44.324	.....
Nov.	71.604	85.891	.....	34.192	43.584	.....
Dec.	75.765	85.960	.....	36.410	43.052	.....
Year	65.661	81.417	.....	31.315	40.851	.....

New York quotations cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

Copper	New York		London			
	Electrolytic		Standard		Electrolytic	
	1917	1918	1917	1918	1917	1918
Jan.	28.673	23.500	131.021	110.000	142.895	125.000
Feb.	31.750	23.500	137.895	110.000	148.100	125.000
Mar.	31.481	23.500	136.750	110.000	151.000	125.000
April	27.935	.....	133.842	.....	147.158	.....
May	28.788	.....	130.000	.....	142.000	.....
June	29.962	.....	130.000	.....	142.000	.....
July	26.620	.....	128.409	.....	140.409	.....
Aug.	25.380	.....	122.391	.....	137.000	.....
Sept.	25.073	.....	117.500	.....	135.250	.....
Oct.	23.500	.....	110.000	.....	125.000	.....
Nov.	23.500	.....	110.000	.....	125.000	.....
Dec.	23.500	.....	110.000	.....	125.000	.....
Year	27.180	.....	124.892	.....	138.401	.....

Tin	New York		London	
	1917	1918	1917	1918
January	44.175	85.500	185.813	293 227
February	51.420	92.000	198.974	311.525
March	54.388	(a)	207.443	318.875
April	55.910	.....	220.171	.....
May	63.173	.....	245.114	.....
June	62.053	.....	242.083	.....
July	62.570	.....	242.181	.....
August	62.681	.....	243.978	.....
September	61.542	.....	244.038	.....
October	61.851	.....	247.467	.....
November	71.740	.....	274.943	.....
December	87.120	.....	298.556	.....
Av. year	61.802	.....	237.563	.....

(a) No average computed.

Lead	New York		St. Louis		London	
	1917	1918	1917	1918	1917	1918
January	7.626	6.782	7.530	6.684	30.500	29.50
February	8.636	6.973	8.595	6.899	30.500	29.50
March	9.199	7.201	9.120	7.091	30.500	29.50
April	9.288	.....	9.158	.....	30.500	.....
May	10.207	.....	10.202	.....	30.500	.....
June	11.171	.....	11.123	.....	30.500	.....
July	10.710	.....	10.644	.....	30.500	.....
August	10.594	.....	10.518	.....	30.500	.....
September	8.680	.....	8.611	.....	30.500	.....
October	6.710	.....	6.650	.....	30.500	.....
November	6.749	.....	6.187	.....	30.500	.....
December	6.375	.....	6.312	.....	30.500	.....
Year	8.787	.....	8.721	.....	30.500	.....

Spelter	New York		St. Louis		London	
	1917	1918	1917	1918	1917	1918
January	9.619	7.836	9.449	7.661	48.329	54.000
February	10.045	7.814	9.875	7.639	47.000	54.000
March	10.300	7.461	10.130	7.286	47.000	54.000
April	9.459	.....	9.289	.....	54.632	.....
May	9.362	.....	9.192	.....	54.000	.....
June	9.371	.....	9.201	.....	54.000	.....
July	8.643	.....	8.472	.....	54.000	.....
August	8.360	.....	8.190	.....	54.000	.....
September	8.136	.....	7.966	.....	54.000	.....
October	7.982	.....	7.813	.....	54.000	.....
November	7.847	.....	7.672	.....	54.000	.....
December	7.685	.....	7.510	.....	54.000	.....
Year	8.901	.....	8.813	.....	52.413	.....

New York and St. Louis quotations, cents per pound. London, pounds sterling per long ton.

Pig Iron, Pgh.	Bessemer‡		Basic‡		No. 2 Foundry	
	1917	1918	1917	1918	1917	1918
January	$35.95	$37.25	$30.95	$33.95	$30.95	$33.95
February	36.37	37.25	30.95	33.95	30.95	33.95
March	37.37	37.25	31.49	33.95	35.91	33.95
April	42.23	.....	38.90	.....	40.06	.....
May	46.94	.....	42.84	.....	43.60	.....
June	54.22	.....	50.05	.....	50 14	.....
July	57.45	.....	53.80	.....	53.95	.....
August	54.17	.....	50.37	.....	53.95	.....
September	46.40	.....	42.24	.....	48.58	.....
October	37.25	.....	33.95	.....	33.95	.....
November	37.25	.....	33.95	.....	33.95	.....
December	37.25	.....	33.95	.....	33.95	.....
Year	$43.57	.....	$39.62	.....	$40.83	.....

‡ As reported by W. P. Snyder & Co.